EML 7

Instruction Manual

MODEL 750A

REFERENCE
VOLTAGE DIVIDER

FLUKE
ELECTRONICS FOR INDUSTRY
INSTRUMENTS / COMPONENTS

JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133

© Copyright, John Fluke Mfg. Co., Inc.
September, 1968

MODEL 750A

REFERENCE VOLTAGE DIVIDER

750A serial no. _____ and above.

Warranty

The JOHN FLUKE MFG. CO., INC. warrants each instrument manufactured by them to be free from defects in material and workmanship. Their obligation under this Warranty is limited to servicing or adjusting an instrument returned to the factory for that purpose, and to making good at the factory any part or parts thereof; except tubes, fuses, choppers and batteries, which shall, within one year after making delivery to the original purchaser, be returned by the original purchaser with transportation charges prepaid, and which upon their examination shall disclose to their satisfaction to have been thus defective. If the fault has been caused by misuse or abnormal conditions of operation, repairs will be billed at a nominal cost. In this case, an estimate will be submitted before work is started, if requested.

If any fault develops, the following steps should be taken:

1. Notify the John Fluke Mfg. Co., Inc., giving full details of the difficulty, and include the Model number, type number, and serial number. On receipt of this information, service data or shipping instructions will be forewarded to you.

2. On receipt of the shipping instructions, forward the instrument prepaid, and repairs will be made at the factory. If requested, an estimate of the charges will be made before the work begins, provided the instrument is not covered by the Warranty.

SHIPPING

All shipments of John Fluke Mfg. Co., Inc. instruments should be made via Railway Express prepaid. The instrument should be shipped in the original packing carton; or if it is not available, use any suitable container that is rigid. If a substitute container is used, the instrument should be wrapped in paper and surrounded with at least four inches of excelsior or similar shock-absorbing material.

CLAIM FOR DAMAGE IN SHIPMENT

The instrument should be thoroughly inspected immediately upon receipt. All material in the container should be checked against the enclosed packing list. The manufacturer will not be responsible for shortages against the packing sheet unless notified immediately. If the instrument fails to operate properly, or is damaged in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent, and this report should be forwarded to John Fluke Mfg. Co., Inc. Upon receipt of this report you will be advised of the disposition of the equipment for repair or replacement. Include the model number, type number, and serial number when referring to this instrument for any reason.

The John Fluke Mfg. Co., Inc. will be happy to answer all application questions which will enhance your use of this instrument. Please address your requests to: JOHN FLUKE MFG. CO., INC., P.O. BOX 7428, SEATTLE, WASHINGTON 98133.

© COPYRIGHT, JOHN FLUKE MFG. CO., INC., 1970

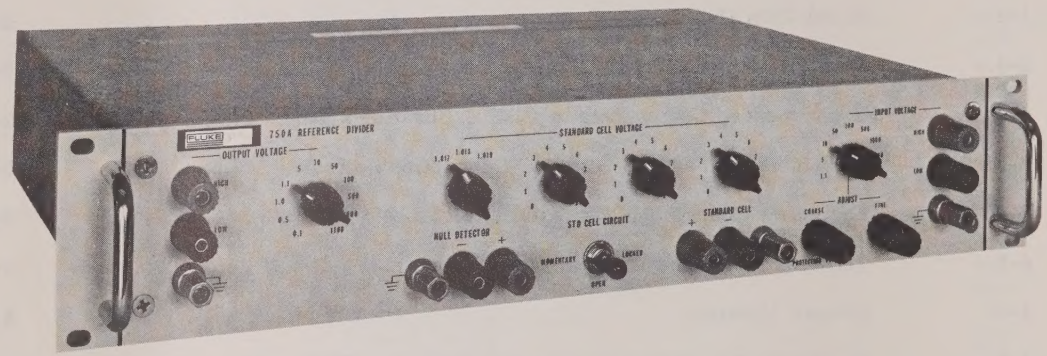
TABLE OF CONTENTS

Section	Title	Page
I	INTRODUCTION AND SPECIFICATIONS	1-1
	1-1. Introduction	1-1
	1-5. Specifications	1-1
II	OPERATING INSTRUCTIONS	2-1
	2-1. Introduction	2-1
	2-3. Temperature Control	2-1
	2-5. Functions of Controls and Terminals	2-1
	2-7. Use in a DC Calibration System	2-1
	2-9. Operation of the DC Calibration System	2-1
	2-11. Applications	2-3
	2-12. Calibrating Voltage Standards	2-3
	2-14. DC Voltage Stability Measurements	2-3
	2-16. Notes on Operation	2-6
	2-17. Standard Cells	2-6
	2-20. Overvoltage Trip	2-6
	2-22. Output Current	2-6
	2-24. Servicing Information	2-6
III	THEORY OF OPERATION	3-1
	3-1. Purpose of the Model 750A	3-1
	3-3. The Main Divider String	3-1
	3-5. Standard Cell Voltage Controls	3-1
	3-7. Overvoltage Circuit	3-1

Section	Title	Page
IV	MAINTENANCE	4-1
	4-1. Introduction	4-1
	4-3. Test Equipment Required for Maintenance	4-1
	4-5. Preventive Maintenance	4-1
	4-7. Battery Replacement	4-1
	4-9. Leakage Resistance Test	4-2
	4-11. Cleaning	4-2
	4-13. Calibration	4-2
	4-14. General Discussion	4-2
	4-16. Overvoltage Trip Check	4-2
	4-17. Calibration Check of 0.1, 0.5, and 1 Volt Taps	4-3
	4-18. Calibration of the Standard Cell Output and 1.1 Volt Taps	4-3
	4-19. Calibration of the 5, 10, 50, 100, 500, 1000, 1100 Volt Taps	4-3
	4-20. Troubleshooting	4-6
	4-22. Checking the Main Divider String	4-6
	4-25. Checking the Standard Cell Voltage Circuit	4-6
	4-27. Troubles in the Overvoltage Circuit	4-7
	4-29. Repair	4-7
V	LIST OF REPLACEABLE PARTS	5-1
	5-1. Introduction	5-1
	5-3. Columnar Information	5-1
	5-4. How to Obtain Parts	5-2
	5-7. Abbreviations and Symbols	5-2
	5-8. Serial Number Effectivity	5-16
	APPENDIX A	
	JOHN FLUKE MFG. CO. WARRANTY	
	LIST OF SALES REPRESENTATIVES	
	SCHEMATIC DIAGRAM	

LIST OF ILLUSTRATIONS

Figure	Title	Page
Frontispiece	Model 750A Reference Voltage Divider	iii
1-1.	Model 750A Outline Drawing	1-2
2-1.	Location and Function of Controls and Terminals	2-2
2-2.	Recommended Components of a DC Calibration System	2-3
2-3.	Equipment Connections for a DC Calibration System	2-4
2-4.	Equipment Connections for Stability Measurements	2-5
4-1.	Test Equipment Required for Maintenance	4-1
4-2.	Battery Location	4-2
4-3.	Equipment Connections for Leakage Resistance Test	4-4
4-4.	Equipment Connections for Calibration	4-5
4-5.	Tap Calibration Steps	4-8
5-1.	Final Assembly	5-3
5-2.	Front Panel Assembly	5-4
5-3.	Kelvin-Varley Switch Assemblies (Sheet 1 of 2)	5-7
5-3.	Kelvin-Varley Switch Assemblies (Sheet 2 of 2)	5-8
5-4.	Chassis Assembly	5-10
5-5.	Adjustment P/C Assemblies No. 1 thru No. 8	5-13
5-6.	Protection P/C Assembly	5-14
5-7.	Pot Mounting P/C Assembly	5-15



MODEL 750A REFERENCE VOLTAGE DIVIDER

SECTION I

INTRODUCTION AND SPECIFICATIONS

1-1. INTRODUCTION

1-2. The Fluke Model 750A is an extremely accurate and stable reference voltage divider having an input voltage range of 1100 to 1.1 volts dc and an output voltage range of 1100 to 0.1 volts dc. It is intended primarily for the purpose of making traceable measurements through use with a null detector and a standard cell. The combination of reference divider and null detector compares the output voltage of the divider to the standard cell voltage. Traceability is from the divider ratios to the standard cell in use, to the primary standard cell, to the inter-laboratory standard cell, and then to the National Bureau of Standards.

1-3. The primary application of the Model 750A is that of a stable accurate ratio reference for use in a dc calibration system including a voltage source, a standard cell and a null detector. Such a calibration system may be used as a reference for voltage stability measurements by utilizing the recorder output of the null detector as the common input of a recorder. In this application, the stability of the reference approaches that of the standard cell. The Model 750A may also be used as a volt box to extend the measurement range of laboratory potentiometers.

1-4. The use of switches for the selection of input and output voltage taps makes the Model 750A fast and convenient to use. Adjustment potentiometers in the divider string eliminate the need for correction curves. An overvoltage protection circuit is included to prevent operator error from causing damage to the instrument.

1-5. SPECIFICATIONS

INPUT VOLTAGES (Switched)
1.1, 5, 10, 50, 100, 500, 1000, 1100 volts dc.

OUTPUT VOLTAGES (Switched)
0.1, 0.5, 1, 1.1, 5, 10, 50, 100, 500, 1000, 1100 volts dc.

STANDARIZING OUTPUT
1.017000 to 1.019999 volts dc in 1 microvolt steps.

DIVISION RATIO ACCURACY AND STABILITY (Referended to Standard Cell Tap) ±(0.001% of output + 0.5 microvolt) for 1 year.

CALIBRATION
All taps 1.1 volt and above are adjustable to ±10 ppm.

CALIBRATION RESOLUTION
0.2 ppm.

DIVIDER CURRENT
1 milliampere nominal.

INPUT CURRENT ADJUST
Coarse and fine front-panel rheostats provide an input voltage adjustment span of 10 millivolt with better than 1 microvolt resolution.

OVERVOLTAGE PROTECTION
Up to 2,000 volts may be applied on any input range without damage.

OPERATING TEMPERATURE RANGE
15° C to 35° C.

TEMPERATURE COEFFICIENT OF OUTPUT
±1 ppm/° C over operating range.

INITIAL CALIBRATION TEMPERATURE
23(±1)° C.

STORAGE TEMPERATURE RANGE
-62° C to +70° C.

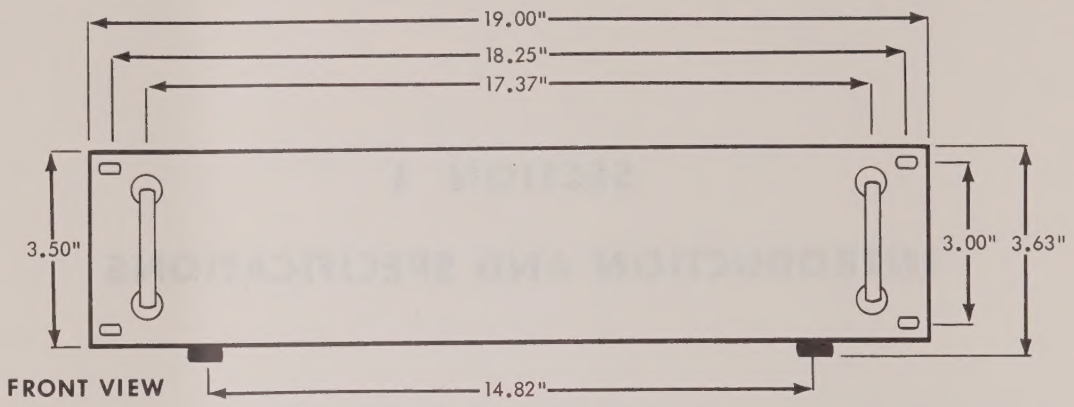
HUMIDITY
0 to 80%.

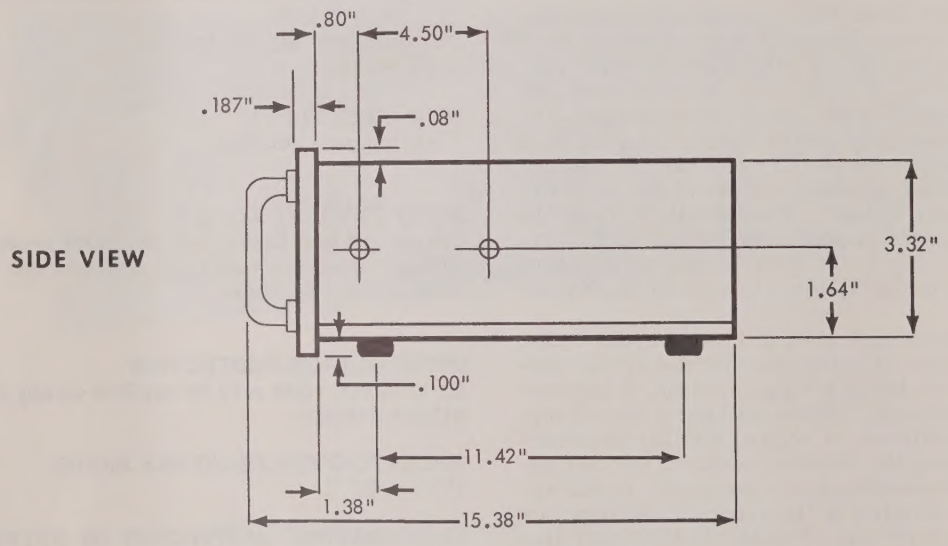
SHOCK
Meets 20g, 11 ms shock tests of MIL-E-4970A.

VIBRATION
Meets 10 Hz - 55 Hz tests of MIL-T-945A.

POWER
Two 6.75 volt mercury batteries power the over-voltage protection circuit. Recommended replacement interval is 1 year.

SIZE
3-1/2" high x 19" wide x 13" behind panel.





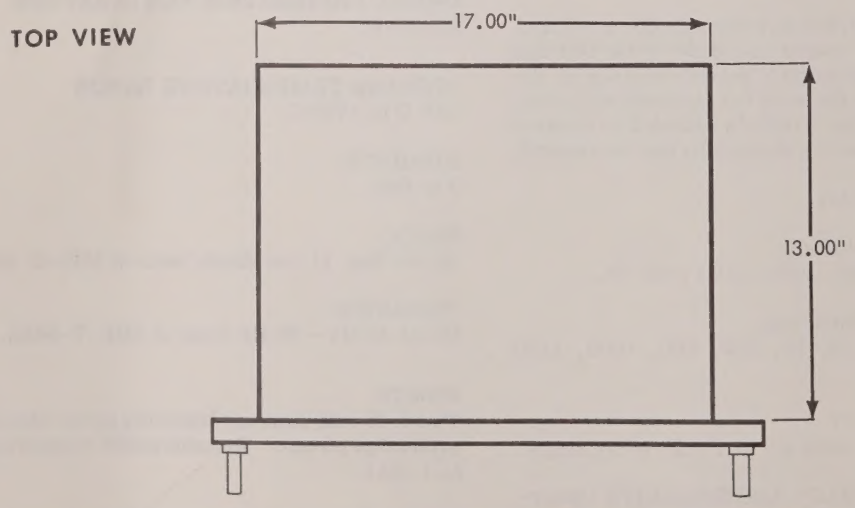


Figure 1-1. OUTLINE DRAWING

SECTION II

OPERATING INSTRUCTIONS

2-1. INTRODUCTION

2-2. This section contains the instructions for use and operation of the Fluke Model 750A. Instructions for use and operation in a dc calibration system and in a dc voltage stability test setup have been included because the primary purpose of the instrument is to provide a means of making voltage measurements of known absolute accuracy traceable to the National Bureau of Standards through a standard cell.

2-3. TEMPERATURE CONTROL

2-4. The Fluke Model 750A is factory calibrated at 23±1° C, and has a temperature coefficient of ±1 ppm/° C. If the instrument is to be used in an environment significantly different from 23° C, it must be recalibrated at the operating temperature or the appropriate derating must be applied to the accuracy of measurement.

2-5. FUNCTIONS OF CONTROLS AND TERMINALS

2-6. The name and function of the controls, terminals, and indicators of the Model 750A may be found in Figure 2-1. The numbered arrow callouts, of Figure 2-1, correspond to the reference numbers in the chart of the same figure.

2-7. USE IN A DC CALIBRATION SYSTEM

2-8. The Model 750A, a dc voltage source, a null detector, and a standard cell comprise a dc calibration system with accuracy of 10 to 30 ppm, depending on the accuracy of the auxilliary equipment used. A list of recommended equipment is given in Figure 2-2.

2-9. OPERATION OF THE DC CALIBRATION SYSTEM

2-10. A dc calibration system based on the Model 750A Reference Divider is shown in Figure 2-3. Connect the equipment as follows:

a. Set INPUT VOLTAGE switch to RESET.

b. Connect the power supply to the INPUT VOLTAGE terminals.

Note!

If a power supply with a grounded output is used, the instrument being calibrated must be ungrounded to avoid ground loop problems.

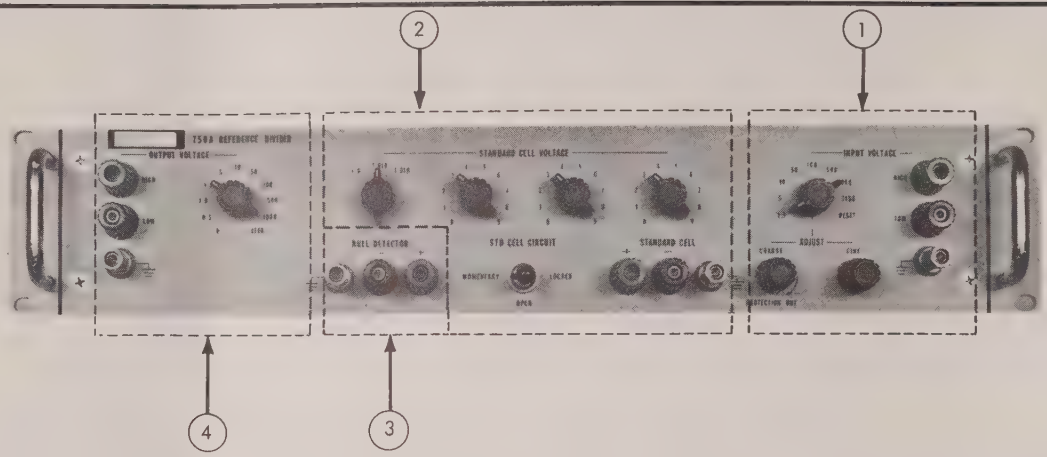
c. Set the polarity switch of the power supply and set the output voltage to the desired output.

d. Set the STANDARD CELL switch to OPEN and set the STANDARD CELL VOLTAGE dials to the correct standard cell voltage.

CAUTION!

The standard cell polarity and the power supply polarity must agree to avoid damaging the standard cell by drawing excessive current from it.

e. Connect the null detector to the NULL DETECTOR binding posts and connect a standard cell to the STANDARD CELL binding posts. This places the null detector and the standard cell in series.



	CONTROL OR TERMINAL	FUNCTION
	INPUT VOLTAGE	
	rotary switch	Used to select the desired input voltage from 1.1 to 1100 volts. In RESET position, disconnects divider string from input terminals and resets overvoltage trip.
(1)	red terminal	High input terminal for connection of input voltage.
	black terminal	Low input terminal for connection of input voltage.
	metallic terminal	Chassis ground terminal for convenience.
	COARSE ADJUST	Coarse trimmer for input voltage adjustment.
	FINE ADJUST	Fine trimmer for input voltage adjustment.
	STANDARD CELL VOLTAGE	
	four rotary switches	Used to set standardizing output of Model 750A to the voltage of the standard cell in use. Any voltage from 1.017000 to 1.019999 may be selected.
(2)	STANDARD CELL	
	red terminal	Used to connect positive terminal of standard cell to reference divider.
	black terminal	Used to connect negative terminal of standard cell to reference divider.
	metallic terminal	Chassis ground terminal for convenience.
	STD CELL CIRCUIT	Toggle switch closes the standard cell circuit to standardize the divider input. Closure may be MOMENTARY or LOCKED.
	NULL DETECTOR	
(3)	red terminal	Used to connect input terminal of null detector to reference divider.
	black terminal	Used to connect common terminal of null detector to reference divider.
	metallic terminal	Chassis ground terminal for convenience.
	OUTPUT VOLTAGE	
	rotary switch	Used to select the desired output voltage from 0.1 to 1100 volts. The selected output voltage must be no higher than the input voltage.
(4)	red terminal	High output terminal.
	black terminal	Low output terminal.
	metallic terminal	Chassis ground terminal for convenience.

Figure 2-1. LOCATION AND FUNCTION OF CONTROLS AND TERMINALS

RECOMMENDED EQUIPMENT	SPECIFICATIONS
DC Voltage Source, Fluke Model 332B	Output voltage to 1100 volts. Minimum noise and ripple, and maximum short-term stability.
Null Detector, Fluke Model 845AB	Full scale sensitivity of 10 uv or better. High input resistance and battery operation are preferred.
Standard cells and enclosure, Guildline Instruments, Model 9152/P4	Saturated cells are recommended. However unsaturated cells may be used with reduced accuracy. Leakage resistance must be at least 10^{11} ohms.

Figure 2-2. RECOMMENDED COMPONENTS OF A DC CALIBRATION SYSTEM

f. Set the INPUT VOLTAGE switch to the desired input voltage.

g. Set the OUTPUT VOLTAGE switch to the desired output.

h. Turn on all equipment including the power supply output and allow it to warm up until it reaches temperature equilibrium.

i. Set the null detector to reduced sensitivity (1 volt, for example).

j. Throw the STANDARD CELL switch to MOMENTARY and note deflection of the null detector. Adjust the COARSE and FINE INPUT VOLTAGE controls and, if necessary, the power supply output voltage to obtain a zero indication on the null detector. Increase sensitivity of the null detector as null is approached. Final null should be on the 10 microvolt range.

k. The selected output voltage is now available at the OUTPUT VOLTAGE terminals and it may be used as a calibration source.

2-11. APPLICATIONS

2-12. CALIBRATING VOLTAGE STANDARDS

2-13. Voltage standards or calibrated power supplies can be calibrated with only the Model 750A, a standard cell, and a null detector. Proceed as follows:

a. Set the STANDARD CELL VOLTAGE dials to the correct standard cell voltage.

b. Set the STANDARD CELL switch to OPEN, and set the null detector for reduced sensitivity.

c. Connect the null detector to the NULL detector binding posts and connect a standard cell to the standard cell binding post.

d. Set the INPUT VOLTAGE switch to RESET.

Note!

Setting the INPUT VOLTAGE switch to RESET disconnects the input terminals and the overvoltage circuit. Failure to set the switch to reset may, at certain output settings, permit sufficient current flow in the overvoltage circuit to seriously impair the accuracy of the calibration being performed.

e. Connect the instrument to be calibrated to the OUTPUT VOLTAGE binding posts and set the OUTPUT VOLTAGE switch to 1100.

CAUTION!

The overvoltage protective circuit is inoperative when voltage is applied to the output binding posts. Care must be taken to prevent decreasing the setting of the OUTPUT VOLTAGE switch without first decreasing the applied voltage. Failure to observe this precaution may damage the equipment.

f. Turn on the equipment and allow it to warmup.

g. Set the output of the instrument being tested to the calibration voltage and set the OUTPUT VOLTAGE switch of the Model 750A to the same voltage.

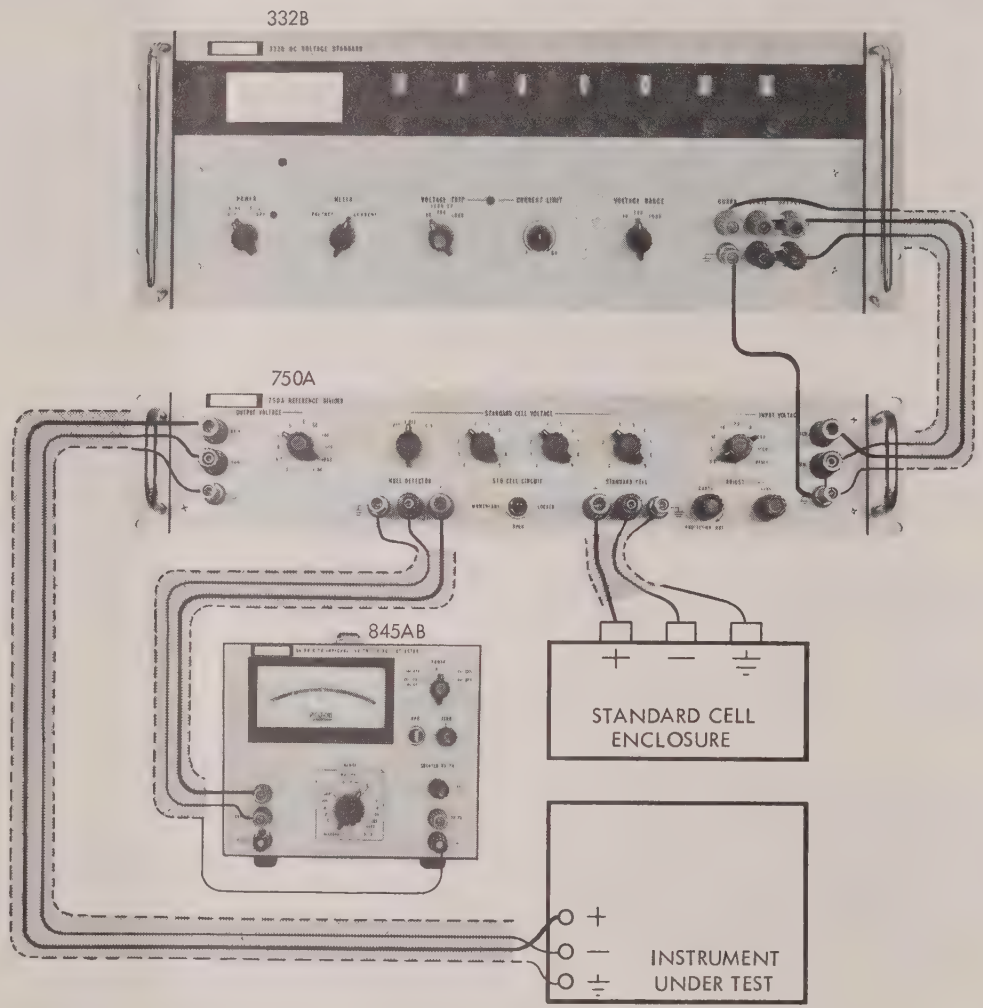
h. Throw the standard cell switch to MOMENTARY and note deflection of the null detector.

i. Adjust the calibration control of the instrument being calibrated increasing null sensitivity until a null is obtained.

j. Repeat steps g through i for each calibration point.

2-14. DC VOLTAGE STABILITY MEASUREMENTS

2-15. Voltage stability measurements can be referenced to a standard cell by using the test setup shown in Figure 2-4. To make stability measurements, connect the equipment and proceed as follows:



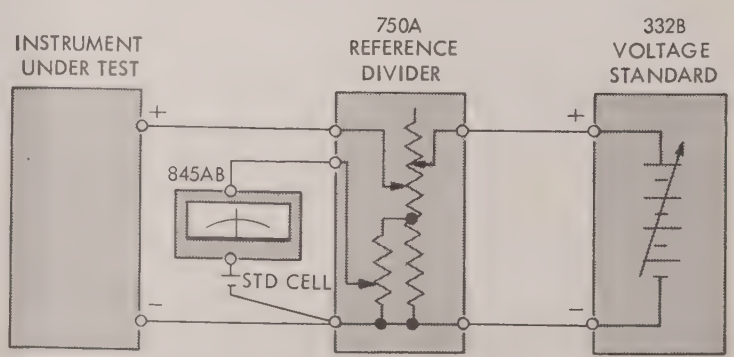


Figure 2-3. EQUIPMENT CONNECTIONS FOR A DC CALIBRATION SYSTEM

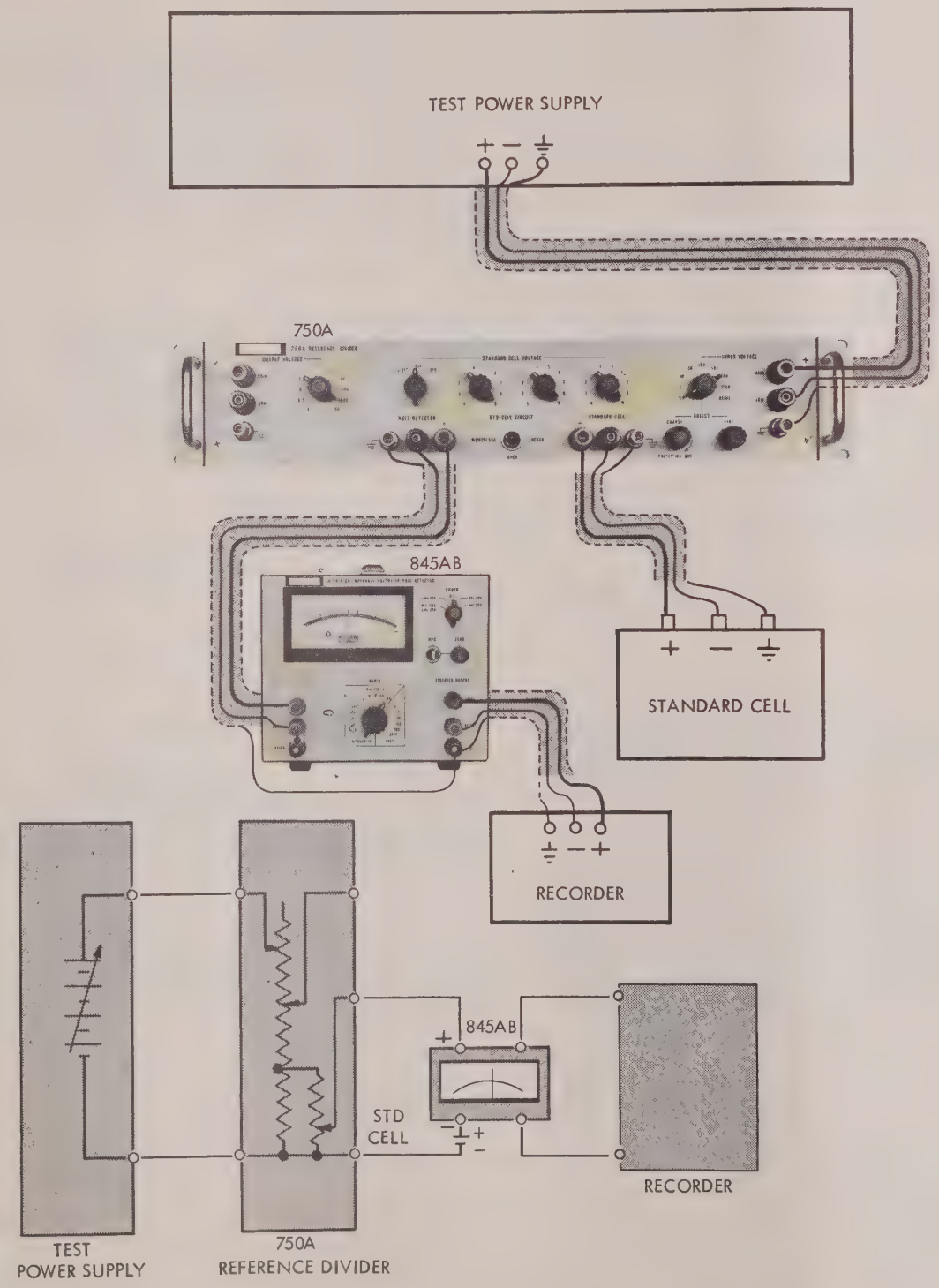


Figure 2-4. EQUIPMENT CONNECTIONS FOR STABILITY MEASUREMENTS

a. Set the power supply output and the INPUT VOLTAGE switch to the same value.

b. Turn on the equipment and allow it to warm up until it reaches temperature equilibrium.

c. Set the STANDARD CELL VOLTAGE dials to the correct standard cell voltage.

d. Throw the STANDARD CELL switch to MOMENTARY and adjust the COARSE and FINE INPUT VOLTAGE controls to obtain a zero indication on the null detector at the desired sensitivity.

e. Throw the STANDARD CELL switch to LOCKED position and adjust the recorder output controls of the null detector and the recorder controls to obtain the desired sensitivity on the recording.

Note!

For best results over long intervals it is essential that ambient temperature be maintained at a constant level because of its effect on all parts of the system. If the test is conducted in an environment with a cyclic temperature variation of a few degrees, the stability recording will be found to track the temperature cycles.

2-16. NOTES ON OPERATION

2-17. STANDARD CELLS

2-18. The standard cells provide traceability of the measurement to the National Bureau of Standards. Consequently they should be cared for and used properly. The cells should be compared weekly to saturated cells having traceability to the National Bureau of Standards.

2-19. The function of a standard cell is to provide a fixed standard emf at very low current. Current drain from a standard cell causes a slow, permanent change in cell voltage. If the STANDARD CELL switch is set to LOCKED and the overvoltage trip removes input voltage from the reference divider, the standard cell will discharge through the null detector resistance. Consequently, the STANDARD CELL switch should never be left in the LOCKED position when a null detector having low input resistance (for example, a galvanometer) is used.

2-20. OVERVOLTAGE TRIP

2-21. The overvoltage trip circuit prevents damage to the divider string resistors caused by reducing the setting of the INPUT VOLTAGE switch without reducing the input voltage. This circuit opens the input when the input voltage exceeds approximately 140% of the INPUT VOLTAGE switch setting. The overvoltage trip circuit is powered by two batteries which should be replaced once a year. See Section IV for battery replacement instructions.

2-22. OUTPUT CURRENT

2-23. Occasionally it may be necessary to provide a small output current at a given output voltage. When this need arises, the input voltage usually should be set to the same level as the output voltage to prevent current flow from the divider string. However, if the power supply being used has poor stability at low voltage, it may be desirable to set the input higher than the output voltage to reduce variation in the output.

Note!

Output current will be limited to approximately 0.4 milliampere by the overvoltage trip circuit.

To draw output current from the divider string, apply the load and increase the input voltage to obtain zero indication on the null detector.

2-24. SERVICING INFORMATION

2-25. The John Fluke Manufacturing Co., Inc. warrants each instrument manufactured by them for the period of one year upon making delivery of the instrument to you, the original purchaser. Complete warranty information is contained in the Warranty page located at the rear of this manual.

2-26. If you should encounter any problem in the operation of your instrument, please feel free to contact your nearest John Fluke Sales Representative or write directly to the John Fluke Manufacturing Co., Inc. with a statement of your problem.

SECTION III

THEORY OF OPERATION

3-1. PURPOSE OF THE MODEL 750A

3-2. The Model 750A provides a means of accurately comparing specific voltages from 0.1 volt to 1100 volts to the known potential of a standard cell. It may be used as a standardizing link in a dc calibration system or it may be used for direct comparison of power supply output and standard cell voltage.

3-3. THE MAIN DIVIDER STRING

3-4. The total effective resistance of the main divider string is 1.1 megohms. The input resistance is 1000 ohms per volt of rated input up to 1100 volts resulting in a nominal current of one milliampere. The input voltage may be adjusted by COARSE and FINE rheostats located on the front panel. The span of adjustment of 10 millivolts and resolution of better than one microvolt permit the operator to achieve an exact null. An adjustment in each step of the main divider string is used to compensate for drift during calibration.

3-5. STANDARD CELL VOLTAGE CONTROLS

3-6. The STANDARD CELL VOLTAGE controls shunt the lower end of the main divider string from common to the 1.1 volt tap. These controls form a modified Kelvin-Varley circuit spanning the range from 1.017000 volts to 1.019999 volts. They are used by the operator to obtain from the divider a voltage which will exactly equal the standard cell voltage when the input is at nominal value. This voltage is compared to the output of the standard cell by a null detector and the input to the divider is adjusted to obtain a null.

3-7. OVERVOLTAGE CIRCUIT

3-8. The overvoltage circuit (overvoltage trip) removes the input voltage from the divider when it exceeds approximately 1.4 times the setting of the INPUT VOLTAGE switch. The input voltage is applied to base of Q2 through a tapped resistive string which conducts approximately 0.07 milliampere at rated input voltage. Transistor Q2 is biased off when normal operating voltage is applied to the resistive string. Transistor Q1 is held cut off by Q2. When the input voltage to the divider reaches approximately 1.4 times the setting of the INPUT VOLTAGE switch, the current through the resistive string increases to 0.1 milliampere turning on Q2. Transistor Q2 turns on Q1 allowing capacitor C1 to discharge through the coil of relay K1 opening the input to the divider. Relay K1 is magnetically biased to remain in either the open or closed state until current flow through the coil is reversed. The operator may close the input to the divider by turning the INPUT VOLTAGE switch to RESET. This allows C202 to discharge in the opposite direction through the coil of K1 and also rapidly recharges C201 through R209. Operating power for the overvoltage circuit is furnished by two 6.75 volt mercury batteries.

SECTION IV

MAINTENANCE

4-1. INTRODUCTION

4-2. This section contains the instruction and information required for maintenance and calibration of the Model 750A Reference Divider. Because of the relative simplicity of the instrument and the critical nature of resistance matching and assembly processes, maintenance is limited in scope. When the instrument requires maintenance beyond that for which instructions are given in this manual, it should be returned to the factory for repair and recalibration.

4-3. TEST EQUIPMENT REQUIRED FOR MAINTENANCE

4-4. The test equipment required for maintenance is listed in Figure 4-1. Equivalent or similar units may be substituted for those listed providing they have the required specifications given in the figure.

4-5. PREVENTIVE MAINTENANCE

4-6. Preventive maintenance of the Model 750A consists of battery replacement, leakage testing, and cleaning. Batteries should be replaced annually. The frequency with which leakage testing and cleaning should be performed depends upon the environment of the instrument. In an air conditioned standards laboratory, there will be little contamination of surfaces within the instrument and therefore leakage testing and cleaning will seldom be required. In a contaminated atmosphere leakage testing and cleaning will be required frequently to maintain the accuracy of the instrument.

4-7. BATTERY REPLACEMENT

4-8. The overvoltage trip circuit is powered by two 6.75 volt mercury cells which should be replaced annually. They are located inside a cover on the rear panel of the instrument as shown in Figure 4-2. To replace the cells proceed as follows:

a. Using a screwdriver turn the two battery cover fasteners one-quarter turn counterclockwise.

b. Lift the cover off.

c. Pull the two cells from their clips.

RECOMMENDED EQUIPMENT	SPECIFICATIONS REQUIRED
Voltage source; Fluke Model 332B or Fluke Model 412B	Voltage source of 0 to 1100 vdc. Accuracy of 0.25%. Stability of 0.005% per hour.
DC Differential Voltmeter; Fluke Model 895A	1 microvolt resolution. 100 megohms input resistance.
Standard Divider; Fluke Model 720A	Ratio accuracy of at least 1 ppm. Ratio capability to 1.1.
Lead Compensator; Fluke Model 721A	Any commercial lead compensator is adequate.
DC Power Supply; Fluke Model 412B	Maximum output voltage of at least 1700 vdc.
Null Detector; Fluke Model 845AB	Sensitivity of at least 10 microvolts fullscale. Battery operation.

Figure 4-1. TEST EQUIPMENT REQUIRED FOR MAINTENANCE

d. Place new cells in the clips.

e. Replace the battery cover and secure it by turning the fasteners one-quarter turn clockwise.

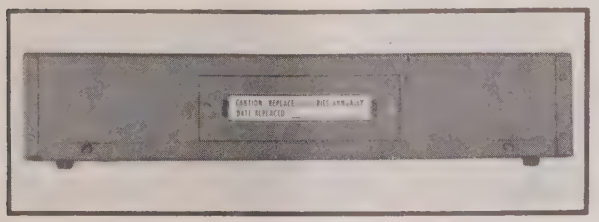


Figure 4-2. BATTERY LOCATION

4-9. LEAKAGE RESISTANCE TEST

4-10. The need for cleaning can be determined without removing the cover from the Model 750A by performing the simple test described in this paragraph. This test should be performed after cleaning to assure that all contamination has been removed. To measure leakage resistance, proceed as follows:

a. Place the Model 750A on a sheet of dielectric.

b. Use teflon insulated wire to connect the Model 750A, a 1000-volt source (Model 332B), and a null detector (Model 845AB) as shown in Figure 4-3.

c. Connect a shunt resistor across the input of the null detector to bring its input resistance to 1 megohm on the 100 millivolt range. The value required for the Model 845AB is 1.1 megohms.

d. Set the INPUT VOLTAGE switch to RESET.

e. Turn on the 1000 volt supply and read the null detector. An indication of 10 millivolts corresponds to 10^{11} ohms. If the voltage indication is above 10 millivolts, the leakage resistance is too low and corrective measures must be taken. If repeated cleaning fails to correct the problem, troubleshooting must be undertaken.

4-11. CLEANING

4-12. When the Model 750A is properly cared for and kept in a controlled atmosphere, cleaning will seldom be required. However, any contamination, particularly oil, in the instrument can contribute to reduced leakage resistance which will impair accuracy. Cleanliness of the switches is critical because low leakage resistance between switch contacts shunts a part of the string. Dust may be removed with dry, oil free air at a pressure of 15 pounds per square inch or less. To remove oil, place the instrument on its side, place paper towels under it, and spray with freon TF degreasing agent.

4-13. CALIBRATION

4-14. GENERAL DISCUSSION

4-15. Calibration of the Model 750A is performed from the low end of the divider to the high end. Calibration adjustments are provided for the outputs 1.1 volt and above. If the 1.0 volt or a lower output is out of tolerance, the instrument must be used with a correction graph or it must be returned to the factory for replacement of the defective resistor. All calibration adjustments are located under the calibration access cover on the top of the instrument. To remove the cover, use a screwdriver to turn the two fasteners counterclockwise. All calibration adjustments are identified underneath the cover. The check procedures must be performed in order for accurate calibration of the instrument.

4-16. OVERVOLTAGE TRIP CHECK

a. Set the INPUT VOLTAGE switch to RESET, PROTECT SWITCH CCW OUT OF DETENT POSITION.

b. Connect a dc voltmeter to the OUTPUT VOLTAGE binding posts and connect the calibrated power supply (Model 332B) to the INPUT VOLTAGE binding posts. Any Fluke dc voltmeter will serve for this check; it should be placed in TVM mode.

c. Set both the INPUT VOLTAGE switch and the OUTPUT VOLTAGE switch to 1.1.

d. Set the power supply to +17 volts and turn it on. The voltmeter should indicate +17 volts.

Note!

If the voltmeter indicates zero, set the INPUT VOLTAGE switch to RESET and then, back to 1.1. If the voltmeter still indicates zero, the overvoltage circuit has failed to close relay K1.

e. Slowly increase the output voltage of the power supply until the overvoltage protection circuit trips. When the circuit trips, the voltmeter indication will drop to zero. The input voltage at this point should be between +18 and +22 volts. 21.4

f. Repeat steps a through e for the remaining input voltage taps of the Model 750A. The switch positions and trip points are tabulated below.

INPUT VOLTAGE SETTING	OUTPUT VOLTAGE SETTING	INPUT VOLTAGE AT TRIP (Approximate)
5 volts	1.1 volts	18 to 22 volts
10 volts	1.1 volts	18 to 22 volts
50 volts	1.1 volts	69 to 83 volts
100 volts	1.1 volts	136 to 167 volts
500 volts	1.1 volts	640 to 780 volts
1000 volts	1.1 volts	1250 to 1530 volts
1100 volts	1.1 volts	1250 to 1530 volts

4-17. CALIBRATION CHECK OF 0.1, 0.5, AND 1 VOLT TAPS

a. Connect the test equipment as shown in Figure 4-4. Use the 1.1 binding post on the standard divider (Model 720A).

b. HIGH LEAD BALANCE. Balance lead and contact resistance on the high side of the dividers as follows:

(1) Set the standard divider to 1.099999X.

(2) Set the Model 750A INPUT VOLTAGE switch and the OUTPUT VOLTAGE switch to 1.1.

(3) Set the voltage source to 10.99999X volts.

(4) Set the lead compensator (Model 721A) to R STD > R TEST.

Note!

The null detector should be operated on battery power for all calibration checks and adjustment procedures.

(5) Adjust the lead compensator high balance to obtain a null indication on the 10 microvolt range of the null detector (Model 845AB) microvolt range.

(6) Set the low balance of the lead compensator to the same setting as the high balance and recheck the null.

(7) Turn the VOLTAGE switch of the lead compensator to off.

c. LOW LEAD BALANCE. Balance the lead and contact resistance on the low side of the divider as follows:

(1) Move the lead from the red OUTPUT VOLTAGE binding post to the black OUTPUT VOLTAGE binding post.

(2) Set the standard divider to 0000000.

(3) Adjust the lead compensator low balance to obtain a null indication on the 10 microvolt range of the null detector.

d. CALIBRATION CHECK OF 0.1 VOLT TAP.

(1) Move the lead from the black OUTPUT VOLTAGE binding post to the red OUTPUT VOLTAGE binding post.

(2) Set the OUTPUT VOLTAGE switch to 0.1.

(3) Set the standard divider to .1000000.

(4) Observe the null detector; it should indicate null ±10 microvolts. If the indication is beyond this tolerance, the instrument should be returned to the factory for repair or a correction graph should be constructed.

Note!

One microvolt is equal to 1 ppm.

e. CALIBRATION CHECK OF 0.5 VOLT TAP.

(1) Set the standard divider to .5000000.

(2) Set the OUTPUT VOLTAGE switch to 0.5.

(3) Observe the null detector; it should indicate null ±50 microvolts. If the indication is beyond this tolerance, the instrument should be returned to the factory for repair or a correction graph should be constructed.

Note!

Five microvolts equal 1 ppm.

f. CALIBRATION CHECK OF 1 VOLT TAP.

(1) Set the standard divider to 1.0000000.

(2) Set the OUTPUT VOLTAGE switch to 1.0.

(3) Observe the null detector; it should indicate null ±100 microvolts. If the indication is beyond this tolerance, the instrument should be returned to the factory for repair or a correction graph should be prepared.

Note!

10 microvolts equal 1 ppm.

4-18. CALIBRATION OF THE STANDARD CELL OUTPUT AND 1.1 VOLT TAPS.

a. Move the lead from the red OUTPUT VOLTAGE binding post to the red NULL DETECTOR binding post.

b. Set the STANDARD CELL VOLTAGE dials to 1.018000.

c. Set the standard divider to 1.0180000.

d. Adjust R87 to obtain a null indication.

4-19. CALIBRATION OF THE 5, 10, 50, 100, 500, 1000, AND 1100 VOLT TAPS.

a. Move the lead from the red NULL DETECTOR binding post to the red OUTPUT VOLTAGE binding post.

b. HIGH LEAD BALANCE. Balance lead resistance on the high side of the dividers, before calibrating each tap, as follows:

(1) Set the Model 750A INPUT VOLTAGE and OUTPUT VOLTAGE switches to the tap being calibrated.

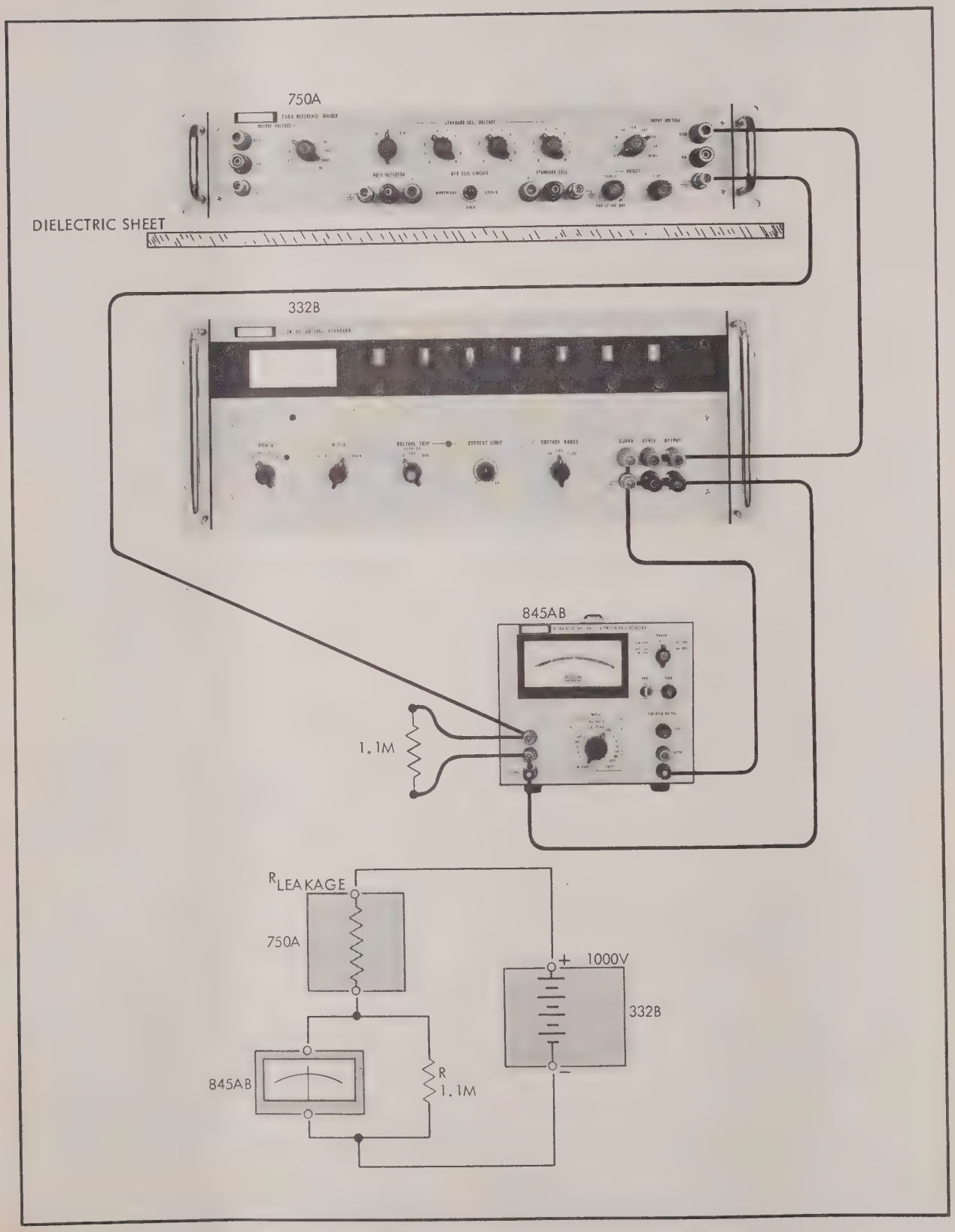


Figure 4-3. EQUIPMENT CONNECTIONS FOR LEAKAGE RESISTANCE TEST

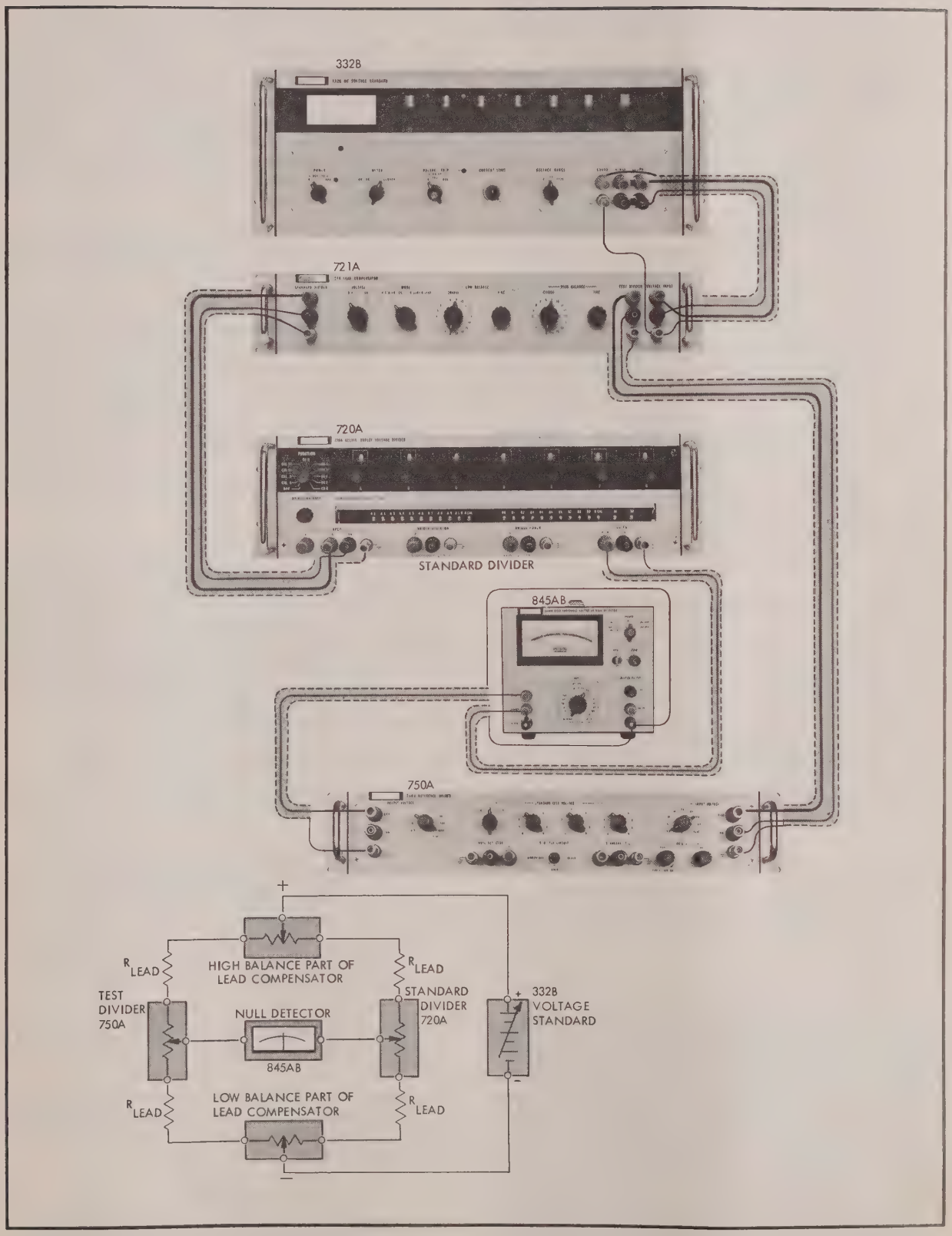


Figure 4-4. EQUIPMENT CONNECTIONS FOR CALIBRATION

(2) Use the 1.0 input binding post on the standard divider except when calibrating the 1100 volt tap.

(3) Set the standard divider to .999999X.

(4) Set the voltage source to the output voltage given in Figure 4-5.

(5) On the lead compensator, set the mode switch to the position listed in Figure 4-5 and turn the voltage switch on.

(6) Adjust the high balance controls to obtain a null indication on the null detector.

c. LOW LEAD BALANCE. Balance lead resistance on the low side of the dividers before calibrating each tap, as follows:

(1) Move the lead from the red OUTPUT VOLTAGE binding post to the black OUTPUT VOLTAGE binding post.

(2) Set the standard divider output to .0000000.

(3) Adjust the low balance controls to obtain a null indication on the null detector.

d. CALIBRATION OF TAPS.

(1) Set the INPUT VOLTAGE switch to 5.

(2) Set the OUTPUT VOLTAGE switch to 1.1.

(3) Set the mode switch of the lead compensator to $R_{STD} > R_{TEST}$.

(4) Set the voltage source to 5 volts.

(5) Adjust high lead balance and low lead balance using the procedures given in paragraphs b and c.

(6) Adjust R34 to obtain an indication of null ±1.1 microvolts.

Note!

To calibrate the remaining taps, refer to the information given in Figure 4-5 for steps d through j and use the procedure given in (1) through (6) of d above.

4-20. TROUBLESHOOTING

4-21. The following paragraphs describe the procedures to be followed if troubles develop in the Model 750A Reference Divider. Sufficient information is given to determine the nature of the trouble and whether the repair should be performed in the field or the instrument should be returned to the manufacturer for repair. Electrical components in the standard cell voltage circuit may be replaced in the field using parts ordered from the manufacturer. The variable trimmer resistors in the main divider string may be replaced in the field. Fixed resistors housed in the oil-filled can and factory selected fixed resistors should be replaced only by the manufacturer.

4-22. CHECKING THE MAIN DIVIDER STRING

4-23. Trouble in the main divider string may be localized to a particular step by utilizing the calibration procedure to check linearity. When the trouble has been localized, repair efforts should be confined to checking and replacing the variable trimmer resistor. If another resistor in the string is faulty, the instrument should be returned to the factory for repair and recalibration. To troubleshoot the main divider string proceed as follows:

a. Perform the calibration checks described in paragraph 4-17. Inability to obtain a reading within the stated tolerance for any of these checks indicates the need for factory maintenance.

b. Perform the tap calibration procedure described in paragraph 4-24. Each tap should be within 1 ppm of the correct value. If any tap is beyond this limit, a resistor in the step is defective. The variable trimmer resistor should be checked and replaced if defective. If a fixed resistor is defective the instrument should be returned to the factory for repair.

4-25. CHECKING THE STANDARD CELL VOLTAGE CIRCUIT

4-26. The source of trouble in the standard cell voltage circuit (a modified Kelvin-Varley divider) may be located easily by a simple linearity check. This check will locate the trouble to a particular defective resistor or switch contact. If used analytically, it will reveal whether the trouble in a faulty resistor is value change, open circuit, or short circuit. Referring to the schematic diagram will aid in understanding the procedure and analyzing the results. To check the standard cell voltage circuit, proceed as follows:

a. Turn the INPUT VOLTAGE switch to RESET.

b. Set the voltage source (Model 332B) to 11.00000 volts.

c. Connect the voltage source to the OUTPUT VOLTAGE terminals, turn the OUTPUT VOLTAGE switch to 1.1, and turn the voltage source on.

d. Connect the differential voltmeter (Model 895A) between the positive (red) NULL DETECTOR terminal and the negative (black) STANDARD CELL terminals.

e. Turn the STANDARD CELL VOLTAGE controls to 1.017000. The differential voltmeter should read 10.17000 volts.

f. Observe the differential voltmeter and advance the right hand control switch one position at a time. The measured voltage should increase 10 microvolts for each step.

Note!

If all steps are equal but low (under 10 uv), the shunt R1124 is under value or shorted.

In this case, the voltage measured in step e will be a few microvolts high. If all steps are equal but high (over 10 uv), the shunt R1124 is over value or open. In this case, the voltage measured in step e will be a few microvolts low. If all steps are 10 microvolts low. If all steps are 10 microvolts and equal but one is missing, the switch contact is open. An over value resistor will produce a high step (over 10 uv) and slightly reduce all other steps. An under value resistor will produce a low step (under 10 uv) and slightly increase all other steps. A shorted resistor will cause two successive steps to produce the same output and will increase all other steps by approximately one microvolt. An open resistor will cause an abrupt discontinuity with the voltage remaining constant up to the open resistor. As the open resistor is passed, the voltage will increase and remain constant but high for the remaining steps.

g. Return the right hand dial to zero and advance the next control switch to the left, one position at a time. The measured voltage should increase 100 microvolts for each step.

Note!

If all steps are equal but low (under 100 uv), the shunt R1112 is under value or shorted. In this case, the voltage measured in step e will be a few microvolts high. If all steps are equal but high (over 100 uv), the shunt R1112 is over value or open. In this case, the voltage measured in step e will be a few microvolts low. If all steps are 100 microvolts and equal but one is missing the switch contact is open. An over value resistor will produce two adjacent high steps and slightly reduce all other steps. An under value resistor will produce two adjacent low steps and slightly increase all other steps. A shorted resistor will produce two successive low steps of approximately 50 microvolts and increase all other steps by about six microvolts. An open resistor will produce a constant but high voltage up to the open resistor. When the open resistor is shunted by the switch, the output voltage will drop to near normal (about 2 or 3 uv low). As the open resistor is passed, the voltage will rise to a slightly higher value than before and remain constant for the remaining steps.

h. Return the dial to zero and advance the next control switch to the left, one position at a time. The measured voltage should increase one millivolt for each step.

Note!

The analysis noted step f applies to the results obtained in step g because the switch configurations are the same. The shunt is R1005. The voltage errors noted in step f will be 10 times as great for step g.

i. Return the dial to zero and advance the left hand control switch to 1.018 and then to 1.019. The measured voltage should increase to 1.018000 volts and then to 1.019000 volts.

Note!

As the switch is advanced so the contacts span an open or over value resistor the measured voltage will be high. An open resistor in the string above the contacts will cause a reading of zero. An open resistor in the string below the contacts will cause a reading of 1.1 volts. An over value resistor above the contacts will cause a low reading. An over value resistor in the string below the contacts will cause a high reading. As the switch is advanced to span a shorted resistor the measured voltage will remain unchanged. As the switch is advanced to span an under value resistor the measured voltage will be low. An under value resistor in the string above the contacts will cause a high reading. An under value resistor in the string below the contacts will cause a low reading.

4-27. TROUBLES IN THE OVERVOLTAGE CIRCUIT

4-28. If trouble in the overvoltage circuit is suspected, the overvoltage trip check given in paragraph 4-16 should be performed. If operation is not satisfactory, check the batteries (BT1 and BT2) and relay K1. If the voltage of either battery is below 6.0 volts, both batteries should be replaced. To check the relay remove the batteries and furnish 5.5 volts to the coil first in one direction and then the other. The relay contacts should open when the voltage is applied on one direction and close when it is applied in the other. The contacts should remain in position (either open or closed) when the voltage is removed. Contact resistance should not exceed 130 milliohms. If the trouble is not caused by the batteries or relay K1, refer to the schematic diagram and theory of operation to troubleshoot the circuit.

4-29. REPAIR

4-30. In the event that a nonlinearity beyond the range of calibration adjustment is discovered in the main divider string, the following effort should be made to correct the fault. First, return the equipment to the condition in which the nonlinearity was discovered and recheck the measurement. Second, exercise the variable trimmer resistor which is the adjustment for that step by slowly sweeping it from one end of travel to the other. It should provide an adjustment range of approximately 20 microvolts at the 1.1 output tap. This procedure may clean the contacts of the trimmer resistor and correct the fault. If the adjustment range is insufficient or if meter deflection is erratic as the trimmer resistor is swept through its travel, it should be re-

placed. If the fault is found to be in one of the fixed resistors of the string, the instrument should be returned to the factory for repair and recalibration.

4-31. If a defective resistor is found in the standard cell circuit it may be replaced with a repair part ordered from the factory.

STEP	750A INPUT SWITCH SETTING	750A OUTPUT SWITCH SETTING	APPLIED VOLTAGE	LEAD COMPENSATOR MODE SWITCH POSITION	NULL ADJUSTMENT	NULL SENSITIVITY	720 STANDARD DIVIDER SETTING
d.	5	1.1	5v	$R_{STD} > R_{TEST}$	R34	1.1 uv = 1 ppm	.2200000
e.	10	5	10v	$R_{STD} > R_{TEST}$	R29	5 uv = 1 ppm	.5000000
f.	50	10	50v	$R_{STD} > R_{TEST}$	R26	10 uv = 1 ppm	.2000000
g.	100	50	100v	$R_{STD} > R_{TEST}$	R21	50 uv = 1 ppm	.5000000
h.	500	100	100v	$R_{STD} < R_{TEST}$	R14	20 uv = 1 ppm	.2000000
i.	1000	500	100v	$R_{STD} < R_{TEST}$	R11	50 uv = 1 ppm	.5000000
j.	1100	1000	110v	$R_{STD} < R_{TEST}$	R2	100 uv = 1 ppm	1.0000000

Figure 4-5. TAP CALIBRATION STEPS

RED = NEW

HI BAL	LOW BAL	CAL STEP	MODE
7 6	6 5	d.	>
5 5	5 4	e	>
2 2	2 1	f	>
1 1	1 0	g	>
2 2	3 2	h	<
3 3	4 3	i	<
3 3	4 3	j	<

SECTION V

LIST OF REPLACEABLE PARTS

5-1. INTRODUCTION

5-2. This section contains complete descriptions of those parts one might normally expect to replace during the life of the instrument. The first listing is a breakdown of all of the major assemblies in the instrument. Subsequent listings itemize the components in each assembly. Every listing is accompanied by an illustration identifying each component in the listing. Assemblies and subassemblies are identified by name in the parts list and by a ten digit stock number in the illustrations. Components are identified by the schematic diagram reference designation (e.g. R1, C107, DS1). Parts not appearing on the schematic diagram are numbered consecutively throughout the parts list with a whole number.

5-3. COLUMNAR INFORMATION

a. The REF DESIG column indexes the item description to the associated illustration. In general the reference designations are listed under each assembly in alpha-numeric order. Subassemblies of minor proportions are sometimes listed with the assembly of which they are a part. In this case, the reference designations for the components of the subassembly may appear out of order.

b. The DESCRIPTION column describes the salient characteristics of the component. Indention of the description indicates the relationship to other assemblies, components, etc. In many cases it is necessary to abbreviate in this column. For abreviations and symbols used, see the following page.

c. The ten-digit part number by which the item is identified at the John Fluke Mfg. Co. is listed in the STOCK NO. column. Use this number when ordering parts from the factory or authorized representatives.

d. The Federal Supply Code for the item manufacturer is listed in the MFR column. An abbreviated list of Federal Supply Codes is included in the Appendix.

e. The part number which uniquely identifies the item to the original manufacturer is listed in the MFR PART NO column. If a component must be ordered by description, the type number is listed.

f. The TOT QTY column lists the total quantity of the item used in the instrument. Second and subsequent listing of the same item are referenced to the first listing with the abbreviation REF. In the case of optional subassemblies, plug ins, etc. that are not always part of the instrument, the TOT QTY column lists the total quantity of the item in that particular assembly.

g. Entries in the REC QTY column indicate the recommended number of spare parts necessary to support one to five instruments for a period of two years. This list presumes an availability of common electronic parts at the maintenance site. For maintenance for one year or more at an isolated site, it is recommended that at least one of every part in the instrument be stocked.

h. The USE CODE column identifies certain parts which have been added, deleted or modified during the production of the instrument. Each part for which a Use Code has been assigned may be identified with a particular instrument serial number by consulting the Serial Number Effectivity List at the end of the parts list. As Use Codes are added to the list, the TOT QTY column listings are changed to reflect the most current information. Sometimes when a part is changed, the new part can and should be used as a replacement for the original part. In this event a parenthetical note is added in the DESCRIPTION column.

5-4 HOW TO OBTAIN PARTS

5-5. Standard components have been used wherever possible. Standard components may be ordered directly from the manufacturer by using the manufacturer's part number, or parts may be ordered from the John Fluke Mfg. Co. factory or authorized representative by using the Fluke part number. In the event the part you order has been replaced by a new or improved part, the replacement will be accompanied by an explanatory note and installation instructions, if necessary.

5-6. To insure prompt and efficient handling of your order to the John Fluke Mfg. Co., Inc. please list the following information:

a. Quantity.

b. FLUKE Stock Number.

c. Description.

d. Reference Designation.

e. Instrument model and serial number.

For example; 1 each, 4707-171678, Resistor, 100 ohms, ±0.01%, 1/2W, R1002 for 750A, s/n 123.

If you must order structural parts not listed in the parts list, describe the part as completely as possible. A sketch of the part showing its location to other parts of the instrument is usually most helpful.

5-7. LIST OF ABBREVIATIONS

ac	alternating current	mw	milliwatt
Al	Aluminum	na	nanoampere
amp	ampere	nsec	nanosecond
assy	assembly	nv	nanovolt
cap	capacitor	Ω	ohm
car flm	carbon film	ppm	parts per million
C	centigrade	piv	peak inverse voltage
cer	ceramic	p-p	peak to peak
comp	composition	pf	picofarad
conn	connector	plstc	plastic
db	decibel	p	pole
dc	direct current	pos	position
dpdt	double-pole, double-throw	P/C	printed circuit
dpst	double-pole, single-throw	rf	radio frequency
elect	electrolytic	rfi	radio frequency interference
F	fahrenheit	res	resistor
Ge	germanium	rms	root mean square
gmv	guaranteed minimum value	rtry	rotary
h	henry	sec	second
Hz	hertz	sect	section
hf	high frequency	S/N	serial number
IC	integrated circuit	Si	silicon
if	intermediate frequency	scr	silicon controlled rectifier
k	kilohm	spdt	single-pole, double-throw
kHz	kilohertz	spst	single-pole, single-throw
kv	kilovolt	sw	switch
lf	low frequency	Ta	tantalum
MHz	megahertz	tstr	transistor
M	megohm	tvm	transistor voltmeter
met flm	metal film	uhf	ultra high frequency
ua	microampere	vtvm	vacuum tube voltmeter
uf	microfarad	var	variable
uh	microhenry	vhf	very high frequency
usec	microsecond	vlf	very low frequency
uv	microvolt	v	volt
ma	milliampere	va	voltampere
mh	millihenry	vac	volts, alternating current
m	millohms	vdc	volts, direct current
msec	millisecond	w	watt
mv	millivolt	ww	wire wound

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	FINAL ASSEMBLY-Figure 5-1 Front Panel Assembly (See Figure 5-2) Chassis Assembly (See Figure 5-4)	750A					

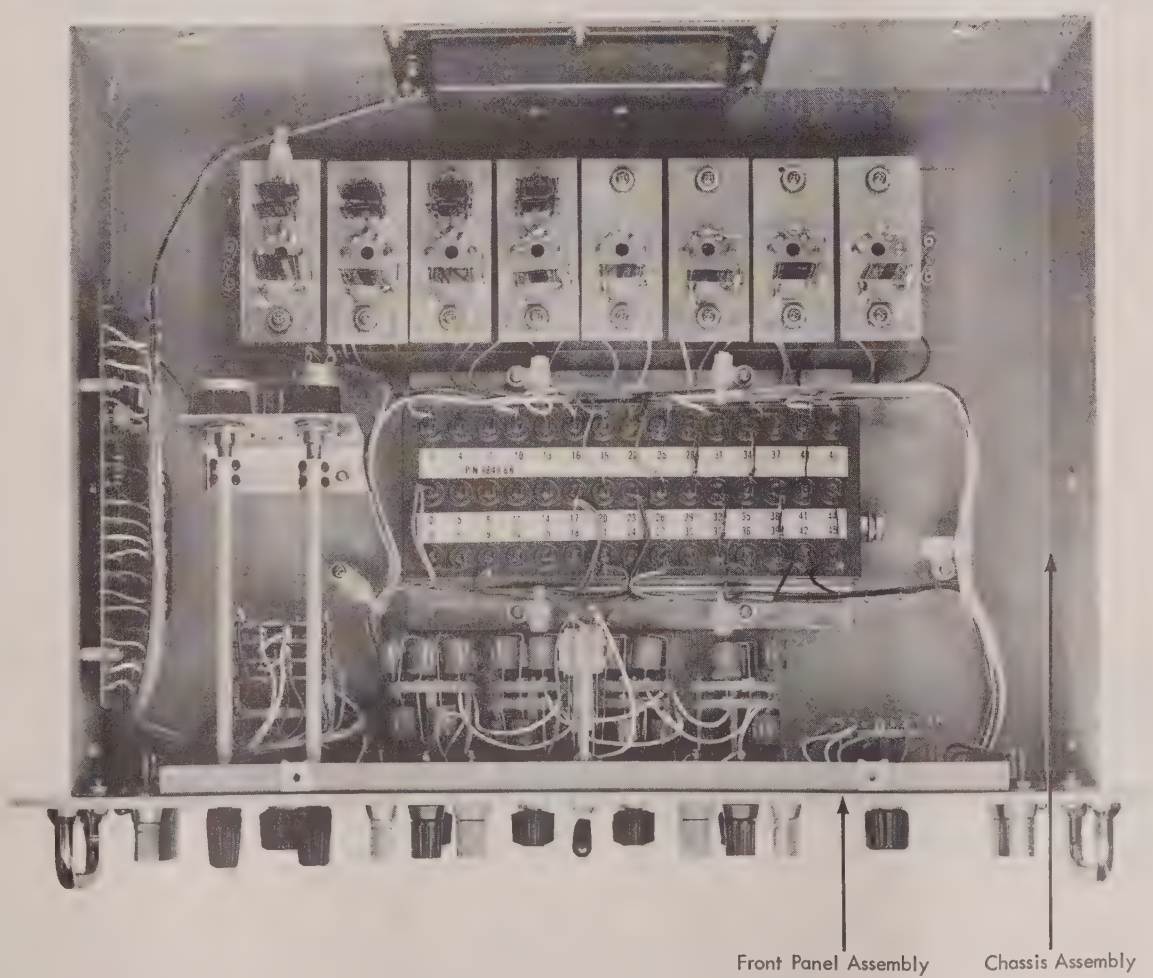
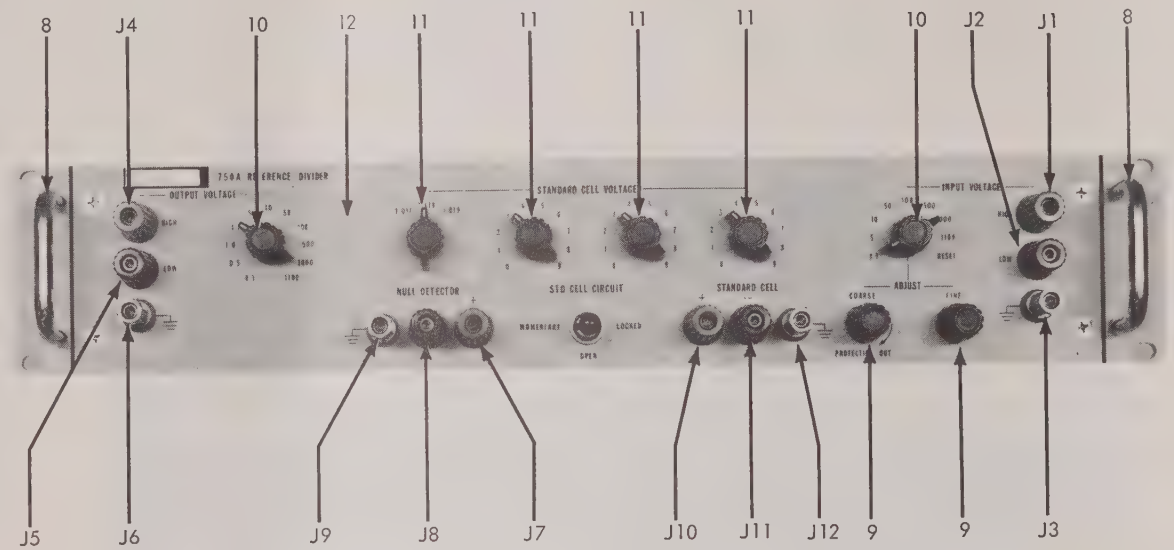


Figure 5-1. FINAL ASSEMBLY



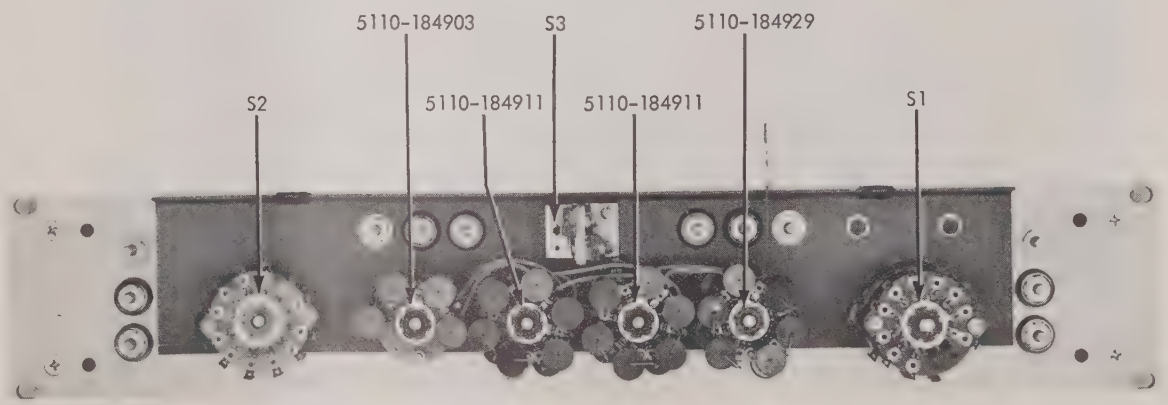


Figure 5-2. FRONT PANEL ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	FRONT PANEL ASSEMBLY - Figure 5-2						
	Kelvin-Varley "A" Switch Assembly (See Figure 5-3)	5110-184903 (750A-410)	89536	5110-184903	1		
	Kelvin-Varley "B" Switch Assembly (See Figure 5-3)	5110-184911 (750A-411)	89536	5110-184911	2		
	Kelvin-Varley "C" Switch Assembly (See Figure 5-3)	5110-184911 (750A-411)	89536	5110-184911	REF		
	Kelvin-Varley "D" Switch Assembly (See Figure 5-3)	5110-184929 (750A-412)	89536	5110-184929	1		
J1	Binding post, red, Input	2811-149856	58474	BHB-10208-G22	4		
J2	Binding post, black, Input	2811-149864	58474	BHB-10208-G21	4		
J3	Binding post, ground	2811-155911	58474	GP30NC	4		
J4	Binding post, red, Output	2811-149856	58474	BHB-10208-G22	REF		
J5	Binding post, black, Output	2811-149864	58474	BHB-10208-G21	REF		
J6	Binding post, ground	2811-155911	58474	GP30NC	REF		
J7	Binding post, red, Standard Cell	2811-149856	58474	BHB-10208-G22	REF		
J8	Binding post, black, Standard Cell	2811-149864	58474	BHB-10208-G21	REF		
J9	Binding post, ground	2811-155911	58474	GP30NC	REF		
J10	Binding post, red, Null Detector	2811-149856	58474	BHB-10208-G22	REF		
J11	Binding post, black, Null Detector	2811-149864	58474	BHB-10208-G21	REF		
J12	Binding post, ground	2811-155911	58474	GP30NC	REF		
S1	Switch, INPUT, rotary, 5p, 9 pos, 5 sect	5105-184531	89536	5105-184531	1		
S2	Switch, OUTPUT, rotary, 1p, 11 pos, 1 sect	5105-184499	89536	5105-184499	1		
S3	Switch, STANDARD CELL, toggle, dpdt	5106-176594	82389	6S-2457	1		
8	Handle, chrome-plated brass	2404-100412	05704	825	2		
9	Knob, COARSE ADJUST, FINE ADJUST	2405-158949	89536	2405-158949	2		
10	Knob, INPUT VOLTAGE, OUTPUT VOLTAGE	2405-170050	89536	2405-170050	2	A	
	KNOB, INPUT VOLTAGE, OUTPUT VOLTAGE	2405- 158956	89536	2405- 158956	6	B	
11	Knob, STANDARD CELL VOLTAGE	2405-158956	89536	2405-158956	REF		
12	Panel, front	1406-184556	89536	1406-184556	1		

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	KELVIN-VARLEY "A" SWITCH ASSEMBLY-Figure 5-3	5110-184903 (750A-410)	89536	5110-184903	REF		
R1001	Res, ww, 100Ω ±0.01%, 1/2w	4707-171678	89536	4707-171678	36	1	
R1002	Res, ww, 100Ω ±0.01%, 1/2w	4707-171678	89536	4707-171678	REF		
R1003	Res, ww, 100Ω ±0.01%, 1/2w	4707-171678	89536	4707-171678	REF		
R1004	Res, ww, 100Ω ±0.01%, 1/2w	4707-171678	89536	4707-171678	REF		
R1005	Res, ww, 250Ω ±0.01%, 1/2w	4707-182220	89536	4707-182220	3	1	
S1001	Switch, rotary, 2p, 3 pos, 2 sect	5105-184507	89536	5105-184507	1		
	KELVIN-VARLEY "B" SWITCH ASSEMBLY-Figure 5-3	5110-184911 (750A-411)	89536	5110-184911	REF		
R1101	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF	1	
R1102	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1103	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1104	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1105	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1106	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1107	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1108	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1109	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1110	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1111	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1112	Res, ww, 250Ω ±0.05%, 1/2w	4707-182220	89536	4707-182220	REF	1	
S1101	Switch, rotary, 2p, 10 pos, 2 sect	5105-184515	89536	5105-184515	2		
	KELVIN-VARLEY "C" SWITCH ASSEMBLY-Figure 5-3	5110-184911 (750A-411)	89536	5110-184911	REF		
R1113	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1114	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1115	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1116	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1117	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1118	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1119	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1120	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1121	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1122	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1123	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1124	Res, ww, 250Ω ±0.05%, 1/2w	4707-182220	89536	4707-182220	REF		
S1102	Switch, rotary, 2p, 10 pos, 2 sect	5105-184515	89536	5105-184515	REF		

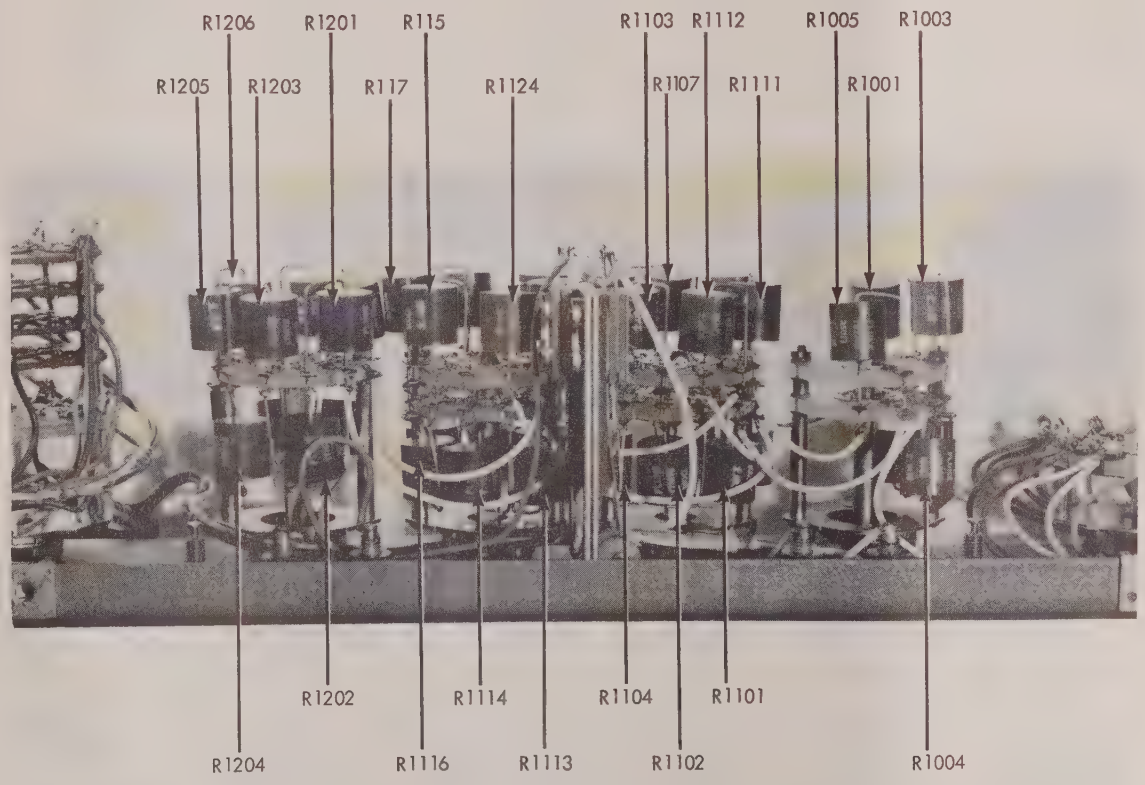


Figure 5-3. KELVIN-VARLEY SWITCH ASSEMBLIES (Sheet 1 of 2)

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	KELVIN-VARLEY "D" SWITCH ASSEMBLY-Figure 5-3	5110-184929 (750A-412)	89536	5110-184929	REF		
R1201	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1202	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1203	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1204	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1205	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1206	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1207	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1208	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1209	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
R1210	Res, ww, 100Ω ±0.05%, 1/2w	4707-171678	89536	4707-171678	REF		
S1201	Switch, rotary, 1p, 10 pos, 1 sect	5105-184523	89536	5105-184523	1		

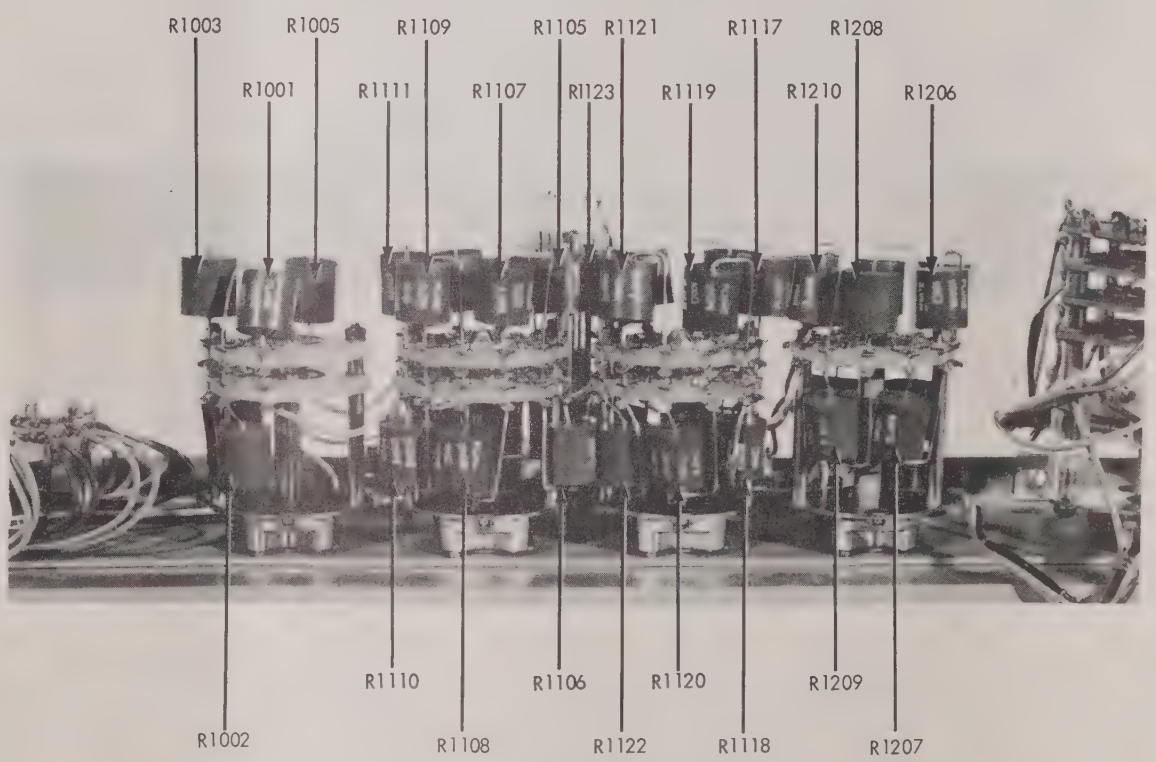


Figure 5-3. KELVIN-VARLEY SWITCH ASSEMBLIES (Sheet 2 of 2)

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	CHASSIS ASSEMBLY-Figure 5-4						
	Adjustment No. 1 P/C Assembly (See Figure 5-5)	1702-184812 (750A-401)	89536	1702-184812	1		
	Adjustment No. 2 P/C Assembly (See Figure 5-5)	1702-184820 (750A-402)	89536	1702-184820	1		
	Adjustment No. 3 P/C Assembly (See Figure 5-5)	1702-184838 (750A-403)	89536	1702-184838	1		
	Adjustment No. 4 P/C Assembly (See Figure 5-5)	1702-184846 (750A-404)	89536	1702-184846	1		
	Adjustment No. 5 P/C Assembly (See Figure 5-5)	1702-184853 (750A-405)	89536	1702-184853	1		
	Adjustment No. 6 P/C Assembly (See Figure 5-5)	1702-184861 (750A-406)	89536	1702-184861	1		
	Adjustment No. 7 P/C Assembly (See Figure 5-5)	1702-184879 (750A-407)	89536	1702-184879	1		
	Adjustment No. 8 P/C Assembly (See Figure 5-5)	1702-184887 (750A-408)	89536	1702-184887	1		
	Protection P/C Assembly (See Figure 5-6)	1702-179416 (750A-409)	89536	1702-179416	1		
	Pot Mounting P/C Assembly (See Figure 5-7)	1702-184937 (750A-413)	89536	1702-184937	1		
	Resistor Can Assembly If a resistor in this assembly requires replacement, the entire instrument must be returned to the factory for repair and recalibration.	4710-184986 (750A-418)	89536	4710-184986	1		
BT1	Battery, 6.75v, Mercury (not illustrated)	4001-150409	37942	TR-135R	2		
BT2	Battery, 6.75v, Mercury (not illustrated)	4001-150409	37942	TR-135R	REF		
1	Case, battery	3155-184630	89536	3155-184630	1		
2	Coupler	2402-104505	89536	2402-104505	2		
3	Cover, battery	3156-184648	89536	3156-184648	1		
4	Cover, bottom	1403-184572	89536	1403-184572	1		
5	Cover, calibration adjustment (not illustrated)	3156-184622	89536	3156-184622	1		
6	Foot, rubber	2819-130138	89536	2819-130138	4		
7	Shaft, pot	2402-184689	89536	2402-184689	2		

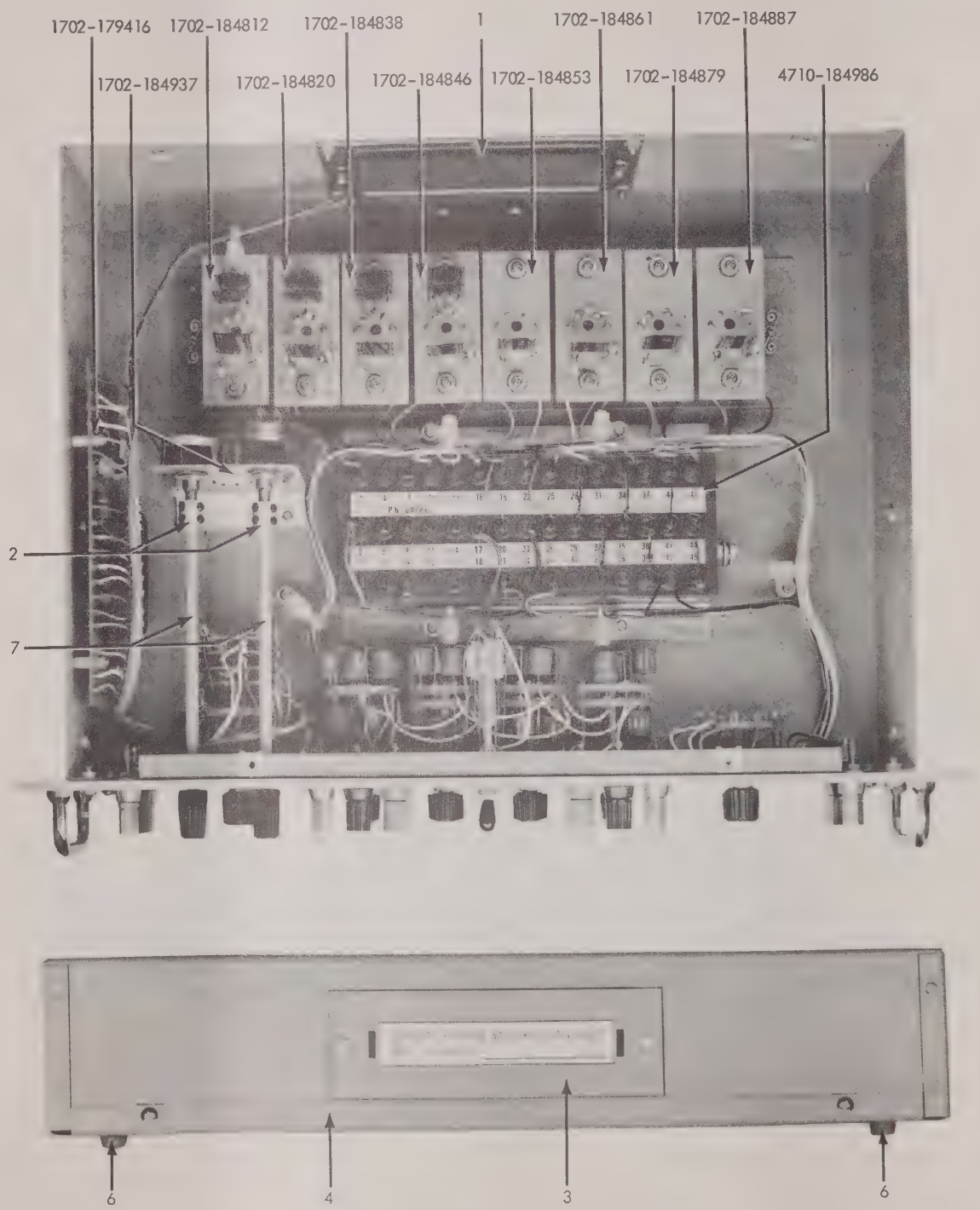


Figure 5-4. CHASSIS ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	ADJUSTMENT NO. 1 P/C ASSEMBLY Figure 5-5	1702-184812 (750A-401)	89536	1702-184812	REF		
R47	Res, ww, factory selected	1					
R86	Res, ww, 10Ω ±0.09%, 1/2w	4707-155879	89536	4707-155879	3	1	
R87	Res, var, ww, 20Ω ±10%, 2w	4702-184457	71450	Type 115	4		
R88	Res, ww, 10Ω ±0.09%, 1/2w	4707-155879	89536	4707-155879	REF		
	ADJUSTMENT NO. 2 P/C ASSEMBLY Figure 5-5	1702-184820 (750A-402)	89536	1702-184820	REF		
R15	Res, ww, factory selected	1					
R33	Res, ww, 0.85Ω ±1%, 1/2w	4707-182378	89536	4707-182378	2	1	
R34	Res, var, ww, 2Ω ±10%, 2w	4702-153445	71450	Type 115	3		
R35	Res, ww, 2Ω ±0.1%, 1/2w	4707-131789	89536	4707-131789	1	1	
	ADJUSTMENT NO. 3 P/C ASSEMBLY Figure 5-5	1702-184838 (750A-403)	89536	1702-184838	REF		
R12	Res, ww, factory selected	1					
R28	Res, ww, 0.85Ω ±1%, 1/2w	4707-182378	89536	4707-182378	REF		
R29	Res, var, ww, 2Ω ±10%, 2w	4702-153445	71450	Type 115	REF		
R30	Res, ww, 1Ω ±1%, 1/2w	4707-131771	89536	4707-131771	2	1	
	ADJUSTMENT NO. 4 P/C ASSEMBLY Figure 5-5	1702-184846 (750A-404)	89536	1702-184846	REF		
R3	Res, ww, factory selected	1					
R25	Res, ww, 10Ω ±0.09%, 1/2w	4707-155879	89536	4707-155879	REF		
R26	Res, var, ww, 20Ω ±10%, 2w	4702-184457	71450	Type 115	REF		
R27	Res, ww, 20Ω ±0.03%, 1/2w	4707-155887	89536	4707-155887	1	1	

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	ADJUSTMENT NO. 5 P/C ASSEMBLY Figure 5-5	1702-184853 (750A-405)	89536	1702-184853	REF		
R20	Res, ww, factory selected	1					
R21	Res, var, ww, 2Ω ±10%, 2w	4702-153445	71450	Type 115	REF		
	ADJUSTMENT NO. 6 P/C ASSEMBLY Figure 5-5	1702-184861 (750A-406)	89536	1702-184861	REF		
R13	Res, ww, factory selected	1					
R14	Res, var, ww, 10Ω ±10%, 2w	4702-183921	71450	Type 115	1		
	ADJUSTMENT NO. 7 P/C ASSEMBLY Figure 5-5	1702-184879 (750A-407)	89536	1702-184879	REF		
R10	Res, ww, factory selected	1					
R11	Res, var, ww, 20Ω ±10%, 2w	4702-184457	71450	Type 115	REF		
	ADJUSTMENT NO. 8 P/C ASSEMBLY Figure 5-5	1702-184887 (750A-408)	89536	1702-184887	REF		
R1	Res, ww, factory selected	1					
R2	Res, var, ww, 20Ω ±10%, 2w	4702-184457	71450	Type 115	REF		

1 These resistors are factory selected. If replacement is required, give model, serial number, full reference designation, and all information stamped on the resistor.

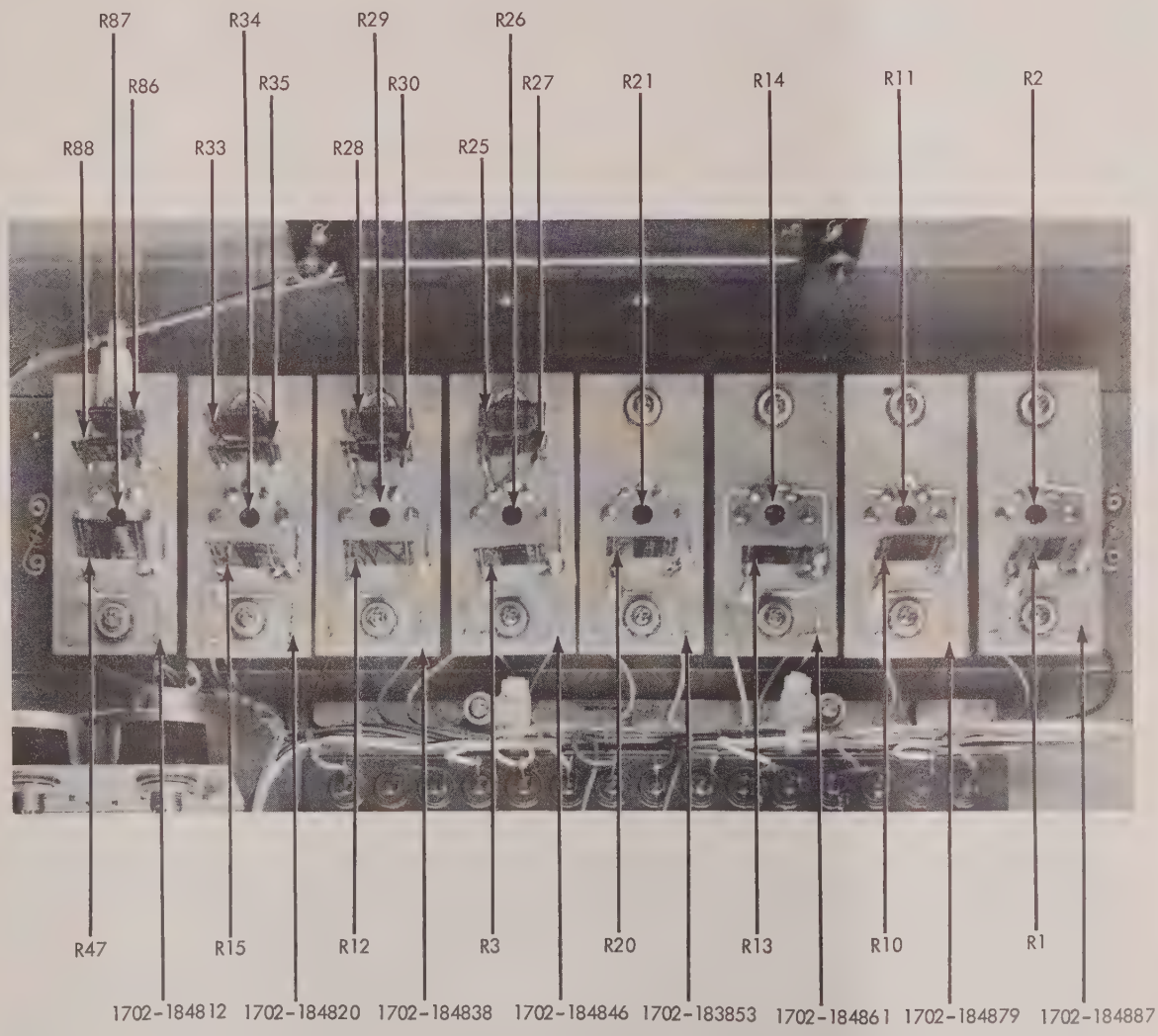


Figure 5-5. ADJUSTMENT P/C ASSEMBLIES NUMBER 1 THROUGH NUMBER 8

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	PROTECTION P/C ASSEMBLY Figure 5-6	1702-179416 (750A-409)	89536	1702-179416	REF		
C201	Cap, Ta, 100 uf ±10%, 10v	1508-170456	05397	K100C10K	2		
C202	Cap, Ta, 100 uf ±10%, 10v	1508-170456	05397	K100C10K	REF		
C203	Cap, plstc, 0.47 uf ±20%, 250v	1507-184366	73445	C280AE/P470K	1		
CR1	Diode, Type 1N4822	4802-112383	05277	1N4822	4	1	
CR2	Diode, Type 1N4822	4802-112383	05277	1N4822	REF		
CR3	Diode, Type 1N4822	4802-112383	05277	1N4822	REF		
CR4	Diode, Type 1N4822	4802-112383	05277	1N4822	REF		
K1	Relay, 6v, SPST	4501-185678	15636	R1407-1	1	1	
Q1	Tstr, Motorola Type MPS3638	4805-169375	04713	MPS3638	1	1	
Q2	Tstr, Type 2N3391	4805-168708	03508	2N3391	1	1	
R201	Res, comp, 6.8M ±5%, 1w	4704-182311	01121	GB6855	1		
R202	Res, comp, 5.6M ±5%, 1w	4704-182295	01121	GB5655	1		
R203	Res, comp, 750k ±5%, 1w	4704-182329	01121	GB7545	1		
R204	Res, comp, 560k ±5%, 1w	4704-182337	01121	GB5645	1		
R205	Res, comp, 120k ±5%, 1w	4704-182303	01121	GB1245	1		
R206	Res, comp, 68k ±10%, 1w	4704-109629	01121	GB6835	1		
R207	Res, comp, 560k ±10%, 1/2w	4704-108795	01121	EB5645	1		
R208	Res, comp, 100k ±5%, 1/2w	4704-168054	01121	EB1045	1		
R209	Res, comp, 1k ±5%, 1/2w	4704-108597	01121	EB1025	1		

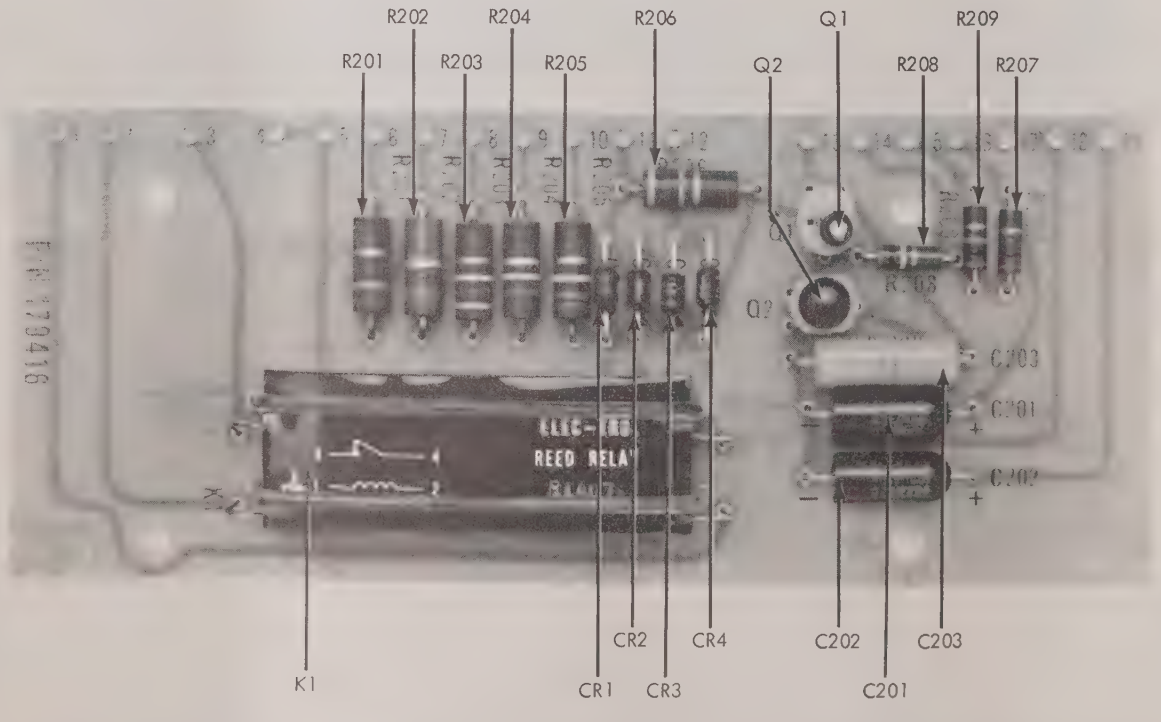


Figure 5-6. PROTECTION P/C ASSEMBLY

REF DESIG	DESCRIPTION	STOCK NO	MFR	MFR PART NO	TOT QTY	REC QTY	USE CODE
	POT MOUNTING P/C ASSEMBLY Figure 5-7	1702-184937 (750A-413)	89536	1702-184937	REF		
R101, S101	Res, var, ww, 10Ω ±10%, 2w	4702-185660	71450	Type 252	1		
R102	Res, ww, 1Ω ±1%, 1/2w	4707-131771	89536	4707-131771	REF		
R103	Res, var, ww, 1Ω ±10%, 2w	4702-185652	71450	Type 2W	1		
R104	Res, ww, 3Ω ±1%, 1/2w	4707-182402	89536	4707-182402	1	1	

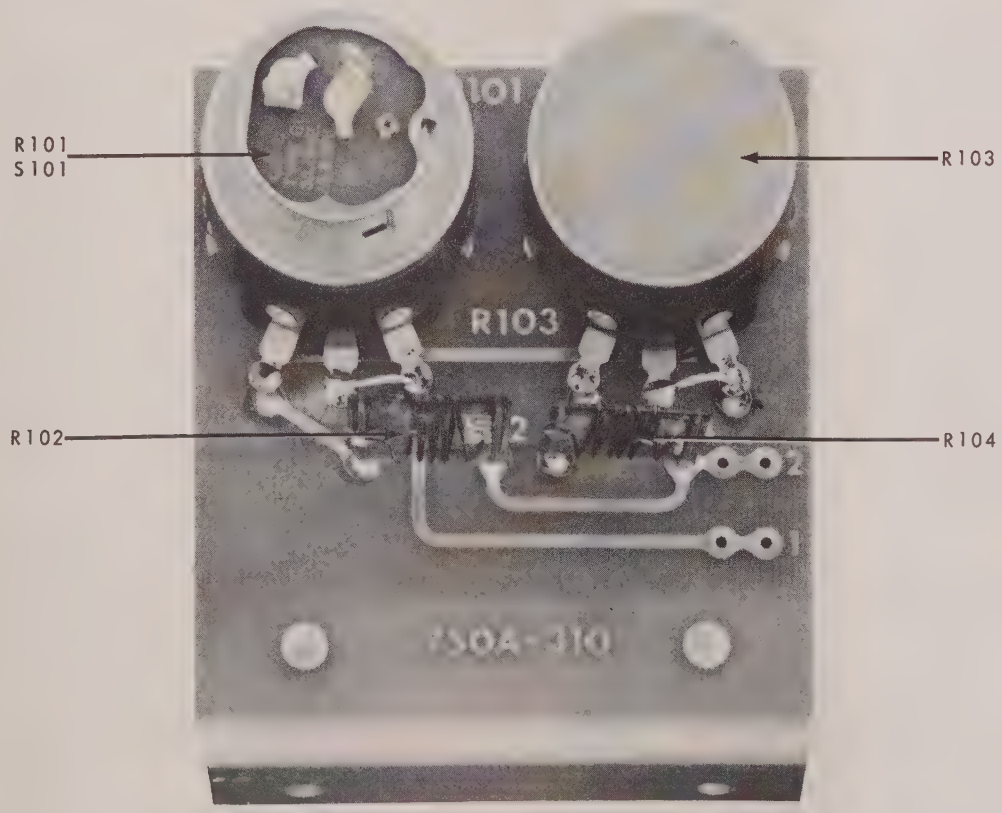


Figure 5-7. POT MOUNTING P/C ASSEMBLY

5-8. SERIAL NUMBER EFFECTIVITY

5-9. A Use Code column is provided to identify certain parts that have been added, deleted, or modified during production of the Model 750A. Each part for which a use code has been assigned may be identified with a particular instrument serial number by consulting the Use Code Effectivity List below. All parts with no code are used on all instruments with serial numbers above 123. New codes will be added as required by instrument changes.

USE CODE	EFFECTIVITY
No Code	Model 750A serial number 123 and on.
A	Model 750A serial number 123 thru 217.
B	Model 750A serial number 218 and on.

Appendix A

Federal Supply Code for Manufacturers

A-1. CODE TO NAME

A-2. The following five-digit code numbers are listed in numerical sequence along with the manufacturer's name and address to which the code has been assigned. The Federal Supply Code has been taken from Cataloging Handbook H 4-2, Code to Name.

00213	Sage Electronics Corp. Rochester, New York
00327	Welwyn International, Inc. Westlake, Ohio
00656	Aerovox Corp. New Bedford, Massachusetts
00779	AMP Inc. Harrisberg, Pennsylvania
01121	Allen-Bradley Co. Milwaukee, Wisconsin
01281	TRW Semiconductors Lawndale, California
01295	Texas Instruments, Inc. Semiconductor Components Div. Dallas, Texas
01686	RCL Electronics Inc. Manchester, New Hampshire
01730	Deleted
01884	Dearborn Electronics Inc. Orlando, Florida
02114	Ferroxcube Corp. Saugerties, New York
02606	Replaced by 15801
02660	Amphenol-Borg Elect. Corp. Broadview, Illinois
02799	Arco Capacitors, Inc. Los Angeles, California
03614	Replaced by 71400
03651	Replaced by 44655
03797	Eldema Corp. Compton, California
03877	Transitron Electronic Corp. Wakefield, Massachusetts
03888	Pyrofilm Resistor Co., Inc. Cedar Knolls, New Jersey
03911	Clairex Corp. New York, New York
03980	Muirhead Instruments, Inc. Mountainside, New Jersey
04009	Arrow Hart and Hegemen Electronic Company Hartford, Connecticut
04062	Replaced by 72136
04202	Replaced by 81312
04217	Essex Wire Corp Wire & Cable Div. Anaheim, California
04221	Aemco Div. of Midtex Inc. Mankato, Minnesota
04645	Replaced by 75376
04713	Motorola Semiconductor Products Inc. Phoenix, Arizona
05082	Replaced by 94154
05236	Jonathan Mfg. Co. Fullerton, California
05277	Westinghouse Electric Corp. Semiconductor Dept. Youngwood, Pennsylvania
05278	Replaced by 43543
05397	Union Carbide Corp. Electronics Div. Cleveland, Ohio
05571	Sprague Electric Co Pacific Div. Los Angeles, California
05704	Alac, Inc. Glendale, California
05820	Wakefield Engineering Ind. Wakefield, Massachusetts
06001	General Electric Company Capacitor Department Irmo, South Carolina
06136	Replaced by 63743
06473	Amphenol Space & Missile Sys. Chatsworth, California
06555	Beede Electrical Instrument Co. Penacook, New Hampshire
06739	Electron Corp. Littletown, Colorado
06743	Clevite Corp. Cleveland, Ohio
06751	Semcor Div. Components Phoenix, Arizona
06860	Gould National Batteries Inc. City of Industry, California
06980	Eitel-McCullough, Inc. San Carlos, California
07115	Replaced by 14674
07138	Westinghouse Electric Corp. Electronic Tube Div. Elmira, New York
07263	Fairchild Semiconductor Div. of Fairchild Camera & Instrument Corp. Mountain View, California
07344	Bircher Co., Inc. Rochester, New York
07792	Lerma Engineering Corp. Northampton, Massachusetts
07910	Continental Device Corp. Hawthorne, California
08530	Reliance Mica Corp. Brooklyn, New York
08792	CBS Electronics Semiconductor Operations-Div. of CBS Inc. Lowell, Massachusetts
08806	General Electric Co. Miniature Lamp Dept. Cleveland, Ohio
08863	Nylomatic Corp. Norrisville, Pennsylvania
08988	Skottie Electronics Inc. Archbald, Pennsylvania
09922	Burndy Corp. Norwalk, Connecticut
11237	Chicago Telephone of Calif. Inc. South Pasadena, California
11358	CBS Electronics Div. of CBS Inc. Newburyport, Massachusetts
11403	Best Products Co. Chicago, Illinois
11503	Keystone Mfg Div. of Avis Industrial Corp. Warren, Michigan
12014	Chicago Rivet & Machine Co. Bellwood, Illinois
12040	National Semiconductor Corp. Danburry, Connecticut
12060	Diodes, Inc. Chatsworth, California
12136	Philadelphia Handle Co. Camden, New Jersey
12323	Presin Co., Inc. Shelton, Connecticut
12327	Freeway Washer & Stamping Co. Cleveland, Ohio
12400	Replaced by 75042
12617	Hamlin Inc. Lake Mills, Wisconsin
12697	Clarostat Mfg. Co. Dover, New Hampshire
12749	James Electronics Chicago, Illinois
12856	Micrometals Sierra Madre, California
12954	Dickson Electronics Corp. Scottsdale, Arizona
13606	Sprague Electric Co. Transistor Div. Concord, New Hampshire
13839	Replaced by 23732
14099	Semtech Corp. Newbury Park, California
14193	California Resistor Corp. Santa Monica, California
14298	American Components, Inc. Conshohocken, Pennsylvania

14655 Cornell-Dubilier Electronics
Newark, New Jersey

14674 Corning Glass Works
Corning, New York

14752 Electro Cube Inc.
San Gabriel, California

14869 Replaced by 96853

15636 Elec-Trol Inc.
Northridge, California

15801 Fenwal Electronics Inc.
Framingham, Massachusetts

15818 Amelco Semiconductor
Div. of Teledyne Inc.
Mountain View, California

15849 Useco, Inc.
Mt. Vernon, New York

15909 Replaced by 17870

16332 Replaced by 28478

16473 Cambridge Scientific Ind. Inc.
Cambridge, Maryland

16742 Paramount Plastics
Downey, California

16758 Delco Radio
Div. of General Motors
Kokomo, Indiana

17069 Circuit Structures Lab.
Upland, California

17856 Siliconix, Inc.
Sunnyvale, California

17870 Daven-Div. of Thomas A. Edison Ind. --McGraw-Edison Co.
Manchester, New Hampshire

18083 Deleted

18178 Vactec Inc.
Maryland Heights, Missouri

18736 Voltronics Corp.
Hanover, New Jersey

19429 Montronics, Inc.
Seattle, Washington

19451 Perine Machinery & Supply Co.
Seattle, Washington

19701 Electra Mfg. Co.
Independence, Kansas

20584 Enochs Mfg. Co.
Indianapolis, Indiana

22767 ITT Semiconductors
Div. of ITT
Palo Alto, California

23732 Tracor
Rockville, Maryland

24248 Southco
Div. of South Chester Corp.
Lester, Pennsylvania

24655 General Radio Co.
West Concord, Massachusetts

25403 Amperex Electronic Corp
Semiconductor & Receiving
Tube Division
Slatersville, Rhode Island

28478 Deltrol Controls Corp.
Milwaukee, Wisconsin

28520 Heyman Mfg. Co.
Kenilworth, New Jersey

30323 Illinois Tool Works Inc.
Chicago, Illinois

33173 General Electric Co.
Tube Dept.
Owensboro, Kentucky

37942 Mallory, P. R., & Co., Inc.
Indianapolis, Indiana

38315 Honeywell Inc.
Precision Meter Div.
Manchester, New Hampshire

42498 National Company
Melrose, Massachusetts

43543 Nytronics Inc.
Transformer Co. Div.
Alpha, New Jersey

44655 Ohmite Mfg. Co.
Skokie, Illinois

49671 Radio Corp. of America
New York, New York

49956 Raytheon Company
Lexington, Maine

53021 Sangamo Electric Co.
Springfield, Illinois

55026 Simpson Electric Company
Chicago, Illinois

56289 Sprague Electric Co.
North Adams, Massachusetts

58474 Superior Electric Co.
Bristol, Connecticut

60399 Torrington Mfg. Co.
Torrington, Connecticut

62460 Deleted

63743 Ward Leonard Electric Co.
Mount Vernon, New York

64834 West Mfg. Co.
San Francisco, California

65092 Weston Instruments Inc.
Newark, New Jersey

66150 Winslow Tele-Tronics Inc.
Asbury Park, New Jersey

70563 Amperite Company
Union City, New Jersey

70903 Belden Mfg. Co.
Chicago, Illinois

71002 Birnbach Radio Co., Inc.
New York, New York

71400 Bussmann Mfg.
Div. of McGraw-Edison Co.
St. Louis, Missouri

71450 CTS Corp.
Elkhart, Indiana

71468 ITT Cannon Electric Inc.
Los Angeles, California

71482 Clare, C P. & Co.
Chicago, Illinois

71590 Centralab
Div. of Globe Union Inc.
Milwaukee, Wisconsin

71707 Coto Coil Co., Inc.
Providence, Rhode Island

71744 Chicago Miniature Lamp Works
Chicago, Illinois

71785 Cinch Mfg. Co. & Howard
B Jones Div.
Chicago, Illinois

72005 Driver, Wilber B., Co.
Newark, New Jersey

72092 Replaced by 06980

72136 Electro Motive Mfg. Co.
Willimantic, Connecticut

72259 Nytronics Inc.
Berkeley Heights, New Jersey

72354 Deleted

72619 Dialight Corp
Brooklyn, New York

72653 G. C. Electronics
Rockford, Illinois

72665 Replaced by 90303

72794 Dzus Fastener Co., Inc.
West Islip, New York

72928 Gudeman Co.
Chicago, Illinois

72982 Erie Tech. Products Inc.
Erie, Pennsylvania

73138 Beckman Instruments Inc.
Helipot Division
Fullerton, California

73293 Hughes Aircraft Co.
Electron Dynamics Div.
Newport Beach, California

73445 Amperex Electronic Corp.
Hicksville, New York

73559 Carling Electric Inc.
Hartford, Connecticut

73586 Circle F Industries
Trenton, New Jersey

73734 Federal Screw Products, Inc.
Chicago, Illinois

73743 Fischer Special Mfg. Co.
Cincinnati, Ohio

73899 JFD Electronics Co.
Brooklyn, New York

73949 Guardian Electric Mfg. Co.
Chicago, Illinois

74199 Quam Nichols Co.
Chicago, Illinois

74217 Radio Switch Corp.
Marlboro, New Jersey

74276 Signalite Inc.
Neptune, New Jersey

74306 Piezo Crystal Co.
Carlisle, Pennsylvania

74542 Hoyt Elect. Instr. Works
Penacook, New Hampshire

74970 Johnson, E. F., Co.
Waseca, Minnesota

75042 IRC Inc.
Philadelphia, Pennsylvania

75376 Kurz-Kasch, Inc.
Dayton, Ohio

75382 Kulka Electric Corp.
Mt. Vernon, New York

75915 Littelfuse Inc.
Des Plaines, Illinois

76854 Oak Mfg. Co.
Crystal Lake, Illinois

77342 Potter & Brumfield
Div. of Amer. Machine & Foundry
Princeton, Indiana

77969 Rubbercraft Corp. of Calif. LTD.
Torrance, California

78189 Shakeproof
Div. of Illinois Tool Works
Elgin, Illinois

78277 Sigma Instruments, Inc.
South Braintree, Massachusetts

78488 Stackpole Carbon Co.
St. Marys, Pennsylvania

78553 Tinnerman Products
Cleveland, Ohio

79136 Waldes Kohinoor Inc.
Long Island City, New York

79497 Western Rubber Company
Goshen, Indiana

79963 Zierick Mfg. Corp.
New Rochelle, New York

80031 Mepco
Div. of Sessions Clock Co.
Morristown, New Jersey

80145 API Instruments Co.
Chesterland, Ohio

80183 Sprague Products
North Adams, Massachusetts

80294 Bourns Inc.
Riverside, California

80583 Hammarlund Co., Inc.
Mars Hill, North Carolina

80640 Stevens, Arnold Inc.
Boston, Massachusetts

81073 Grayhill Inc.
La Grange, Illinois

81312 Winchester Electronics
Div. of Litton Industries
Oakville, Connecticut

81439 Therm-O-Disc Inc.
Mansfield, Ohio

81483 International Rectifier Corp.
El Segundo, California

81590 Korry Mfg. Co.
Seattle, Washington

82376 Deleted

82389 Switchcraft Inc.
Chicago, Illinois

82415 Price Electric Corp.
Frederick, Maryland

82872 Roanwell Corp.
New York, New York

82877 Rotron Mfg. Co., Inc.
Woodstock, New York

82879 ITT Wire & Cable Div.
Pawtucket, Rhode Island

83003 Varo Inc.
Garland, Texas

83298 Bendix Corp.
Electric Power Division
Eatontown, New Jersey

83330 Smith, Herman H., Inc.
Brooklyn, New York

83478 Rubbercraft Corp. of America
New Haven, Connecticut

83594 Burroughs Corp.
Electronic Components Div.
Plainfield, New Jersey

83740 Union Carbide Corp.
Consumer Products Div.
New York, New York

84171 Arco Electronics, Inc.
Great Neck, New York

84411 TRW
Ogallala, Nebraska

86577 Precision Metal Products
Stoneham, Massachusetts

86684 Radio Corp. of America
Electronic Components &
Devices
Harrison, New Jersey

86689 Deleted

87034 Marco-Oak Inc.
Anaheim, California

88419 Use 14655

88690 Replaced by 04217

89536 Fluke, John Mfg. Co., Inc.
Seattle, Washington

89730 Replaced by 08806

90201 Mallory Capacitor Co.
Indianapolis, Indiana

90215 Best Stamp & Mfg. Co.
Kansas City, Missouri

90211 Square D Co.
Chicago, Illinois

90303 Mallory Battery Co.
Tarrytown, New York

91293 Johanson Mfg. Co.
Boonton, New Jersey

91407 Replaced by 58474

91637 Dale Electronics Inc.
Columbus, Nebraska

91662 Elco Corp.
Willow Grove, Pennsylvania

91737 Gremar Mfg. Co., Inc.
Wakefield, Massachusetts

91802 Industrial Devices, Inc.
Edgewater, New Jersey

91836 King's Electronics
Tuckahoe, New York

91929 Honeywell Inc.
Micro Switch Div.
Freeport, Illinois

91934 Miller Electric Co., Inc.
Pawtucket, Rhode Island

93332 Sylvania Electric Products
Semiconductor Products Div.
Woburn, Massachusetts

94145 Replaced by 49956

94154 Tung-Sol
Div. of Wagner Electric Corp.
Newark, New Jersey

95146 Alco Electronics Products Inc.
Lawrence, Massachusetts

95263 Leecraft Mfg. Co.
Long Island City, New York

95264 Replaced by 98278

95275 Vitramon Inc.
Bridgeport, Connecticut

95303 Radio Corp. of America
Solid State & Receiving Tube Div.
Cincinnati, Ohio

95354 Methode Mfg. Corp.
Rolling Meadows, Illinois

95712 Dage Electric Co., Inc.
Franklin, Indiana

95987 Weckesser Co., Inc.
Chicago, Illinois

96733 San Fernando Electric Mfg. Co.
San Fernando, California

96853 Rustrak Instrument Co.
Manchester, New Hampshire

96881 Thomson Industries, Inc.
Manhasset, New York

97540 Master Mobile Mounts
Div. of Whitehall Electronics Corp.
Los Angeles, California

97913 Industrial Electronic Hdware Corp.
New York, New York

97945 White, S. S. Co.
Plastics Div.
New York, New York

97966 Replaced by 11358

98094 Replaced by 49956

98278 Microdot Inc.
Pasadena, California

98291 Sealectro Corp.
Conhex Div
Mamaroneck, New York

98388 Accurate Rubber & Plastics
Culver City, California

98743 Replaced by 12749

98925 Deleted

99120 Plastic Capacitors, Inc.
Chicago, Illinois

99217 Southern Electronics Corp.
Burbank, California

99515 Marshall Industries
Capacitor Div.
Monrovia, California

Appendix C

Sales Representatives & Service Centers

ALABAMA

HUNTSVILLE
BCS Associates, Inc.
2317 Bob Wallace Ave.
P.O. Box 1273
Tel. (205) 881-6220
Zip 35807

ALASKA

SEATTLE
Showalter-Judd, Inc.
1806 S. Bush Place
Seattle, Washington 98144
Tel. (206) 324-7911

ARIZONA

*PHOENIX
Barnhill Associates
537 E. Osborn Road, Suite 4
Tel. (602) 263-1250
Zip 85012

CALIFORNIA

***LOS ANGELES
Instrument Specialists, Inc.
1109 S. Central Ave.
Glendale, California 91204
Tel (213) 245-9404

**SANTA CLARA
Instrument Specialists, Inc.
2359 De La Cruz Blvd.
Tel. (408) 244-1505
Zip 95050

SAN DIEGO
Instrument Specialists, Inc.
1901 State St.
Tel. (714) 232-2017
Zip 92101

COLORADO

*DENVER
Barnhill Associates
1170 S. Sheridan Blvd.
Tel. (303) 934-5505
Zip 80226

CONNECTICUT

HARTFORD
Instrument Representatives, Inc.
P. O. Box 165
Glastonbury, Connecticut 06033
Tel (203) 633-0777

FLORIDA

**ORLANDO
BCS Associates, Inc.
940 N. Fern Creek Ave.
P.O. Box 6578
Tel. (305) 843-1510
Zip 32803

GEORGIA

ATLANTA
BCS Associates, Inc.
1230 Briar Hill Dr.
Tel. (404) 874-9925
Zip 30306

HAWAII

HONOLULU
Industrial Electronics, Inc.
646 Queen Street
P.O. Box 135
Tel. (808) 533-6095
Zip 96817

ILLINOIS

**CHICAGO
Cozzens & Cudahy, Inc.
9501 W. Devon Ave.
Rosemont, Illinois 60018
Tel. (312) 825-1144

INDIANA

INDIANAPOLIS
Cozzens & Cudahy, Inc.
Port O'Call Executive Ctr.
21 Beachway Drive
Tel. (317) 244-2456
Zip 46234

MARYLAND

**BALTIMORE
Electronic Marketing Assoc. Inc.
11501 Huff Court
Kensington, Maryland 20795
Tel. (301) 881-5300

MASSACHUSETTS

**BOSTON
Instrument Representatives, Inc.
1046 Massachusetts Avenue
Arlington, Massachusetts 02174
Tel. (617) 646-1034

MICHIGAN

DETROIT
WKM Associates, Inc.
1474 East Outer Dr.
Tel. (313) 892-2500
Zip 48234

MINNESOTA

MINNEAPOLIS
Cozzens & Cudahy, Inc.
7450 France Ave. So.
Tel. (612) 920-1022
Zip 55435

MISSOURI

ST. LOUIS
Cozzens & Cudahy, Inc.
P. O. Box 10013
Lambert Field - Zip 63145
Tel. (314) 423-1234

NEW JERSEY

**NEWARK
SBM Associates, Inc.
1519 Stuyvesant Avenue
Union, New Jersey 07083
Tel. (201) 687-8737

NEW MEXICO

*ALBUQUERQUE
Barnhill Associates
1410—D Wyoming N.E.
Tel. (505) 299-7658
Zip 87110

NEW YORK

*NEW YORK
SBM Associates, Inc.
28 Hobby Street
Pleasantville, N. Y. 10570
Tel. (914) 769-1811

**ROCHESTER
SBM Associates, Inc.
4515 Culver Rd.
Tel. (716) 266-1400
Zip 14622

NORTH CAROLINA

GREENSBORO
BCS Associates, Inc.
1039 E. Wendover Ave.
P.O. Box 6426
Tel. (919) 273-1918
Zip 27405

OHIO

*CLEVELAND
WKM Associates, Inc.
16141 Puritas Ave.
Tel. (216) 267-0445
Zip 44135

*DAYTON
WKM Associates, Inc.
6073 Far Hills Ave.
Tel. (513) 434-7500
Zip 45429

OREGON

PORTLAND
Showalter-Judd, Inc.
1445 N. E. Arrington
Hillsboro, Oregon 97123
Tel. (503) 648-6372

PENNSYLVANIA

PHILADELPHIA
Electronic Marketing Assoc.
210 Goddard Blvd.—Suite 100
King of Prussia, Pennsylvania
Tel (215) 248-5050
Zip 19406

PITTSBURGH
WKM Associates, Inc.
90 Clairton Blvd.
Tel. (412) 892-2953
Zip 15236

TEXAS

*DALLAS
Barnhill Associates
Suite 220
312 N. Central Express Wy.
Richardson, Texas 75080
Tel. (214) 231-2573

*HOUSTON
Barnhill Associates
Suite 332
3810 Westheimer
Tel. (713) 621-0040
Zip 77027

EAST VIRGINIA

WILLIAMSBURG
BCS Associates, Inc.
107 Rich Neck Road
Tel. (703) 229-5108
Zip 23185

WASHINGTON

SEATTLE
Showalter-Judd, Inc.
1806 S. Bush Place
Seattle, Washington 98144
Tel. (206) 324-7911

CANADA

BRITISH COLUMBIA

VANCOUVER
Allan Crawford Associates, Ltd.
1820 Pandora St.
Tel. (604) 253-7136

ONTARIO

*MALTON
Allan Crawford Associates, Ltd.
6427 Northam Drive.
Tel. (416) 678-1500

OTTAWA, 3
Allan Crawford Associates, Ltd.
376 Churchill Ave. — Suite 106
Tel. (613) 725-3354

QUEBEC

LONGUEUIL
Allan Crawford Associates, Ltd.
157 (rue) St. Charles Street W.
Tel. (514) 670-1212

DOMESTIC SERVICE CENTERS

*** DESIGNATES FLUKE REGIONAL SERVICE CENTER
** DESIGNATES REPRESENTATIVE OFFICES WITH SERVICE CENTERS
* DESIGNATES REPRESENTATIVE OFFICES SERVED BY AUTHORIZED CONTRACT SERVICE LABORATORIES

INTERNATIONAL REPRESENTATIVES

ARGENTINA

Coasin S.A.
Virrey del Pino 4071
Buenos Aires, Argentina

AUSTRALIA

Elmeasco Instruments
7 Chard Road
P.O. Box 324
Brookvale, N.S.W. Australia 2100

AUSTRIA

Kontron GMBH & Co., Kg.
Lederergasse 16
1080 Wien
Austria

BELGIUM

C. N. Rood S/A
37, Place de Jamblinne de Meux
B-1040 Brussels, Belgium

BRAZIL

AMBRIEX S.A.
Av. Graca Aranha
226—6º And.
Rio De Janeiro, Brazil

AMBRIEX S.A.
Av. Pacaembu, 811
Sao Paulo, Brazil

CHILE

Coasin Chile Ltd.
Casilla 14588
Correo 15
Santiago, Chile

DENMARK

Tage Olsen A/S
1, Ronnegade
Copenhagen 0, Denmark

FINLAND

Oy Findip AB
Postbox 52025
Helsinki 52, Finland

FRANCE

Radio Equipment Antares
9, Rue Ernest Cognacq
92 Levallois — Perret
France

HONG KONG

Gilman & Co. Ltd.
P.O. Box 56
Hong Kong

INDIA

Hinditron Services Pvt. Ltd.
69/A Nepean Sea Road
Bombay 6, India

ISRAEL

R.D.T. Electronics Eng'r. Ltd.
P.O. Box 21082
Tel-Aviv, Israel

ITALY

Elettronucleonica S.P.A.
7, P.zza De Angeli
20146 Milano, Italy

JAPAN

Toyo Trading Co., Ltd.
P.O. Box 5014
International Tokyo
Japan

2-38 Junkeicho-dori
Minami-ku, Osaka, Japan

KOREA

M-C International
I.P.O. Box 1355
Seoul, Korea

MALAYSIA

O'Connor's (Pte) Ltd.
P.O. Box 1197
Kota Kinabalu
East Malaysia

P.O. Box 91
Pataling Jaya
West Malaysia

MEXICO

Mexitek, S.A.
Eugenia 408
Departments 1 y 5
Mexico 12, D.F.

THE NETHERLANDS

C.N. Rood N.V.
Post Office Box 4542
Rijswijk (Z.H.) 2100
The Netherlands

Fluke (Nederland) N.V.
Post Office Box 5053
Industrieterrein Noord
Tilburg, The Netherlands

NEW ZEALAND

Elmeasco Instruments (Pty) Ltd.
P.O. Box 213
Mt. Waverley, Vic. 3149
Australia

NORWAY

Morgenstierne & Co. A/S
P.B. 6688 Rodelokka
Oslo 6, Norway

SINGAPORE

O'Connor's (Pte) Ltd.
Maybank House 124-126
Robinson Road
Singapore 1, Singapore

SOUTH AFRICA

K. Baker (Pty.) Ltd.
P.O. Box 1257
Johannesburg, So. Africa

P.O. Box 3641
Cape Town, So. Africa

P.O. Box 2143
Durban, So. Africa

SPAIN

Rema Leo Haag, S.A.
General Sanjurjo 18
Madrid 3, Spain

SWEDEN

Erik Ferner AB
Box 56
161.26 Stockholm-Bromma,
Sweden

SWITZERLAND

Kontron Electronic A.G.
Hardstrasse 235
P.O. Box 193
8031 Zurich
Switzerland

TAIWAN-REPUBLIC OF CHINA

Heighten Trading Co., Ltd.
P.O. 1408
Taipei, Taiwan, 104

THAILAND

G.Simon Radio Ltd.
30 Patpong Avenue
Suriwong
Bangkok, Thailand

THE UNITED KINGDOM

Fluke International Corp.
Garnet Close
Watford, WD2 4TT
England

URUGUAY

Coasin Uruguaya S.A.
Cerrito 617 - 4º Piso
Montevideo, Uruguay

VENEZUELA

Coasin C.A.
APDO, Postal 50939
Sabana Grande No. 1
Caracas, Venezuela

WEST GERMANY

Fey Elektronische Messgeraete
8000 Muenchen 2
Horemansstrasse 28
West Germany

In Europe, contact FLUKE NEDERLAND, N.V., POST OFFICE BOX 5053, INDUSTRIETERREIN NOORD, TILBURG, THE NETHERLANDS

FLUKE REGIONAL SERVICE CENTER; THE NETHERLANDS

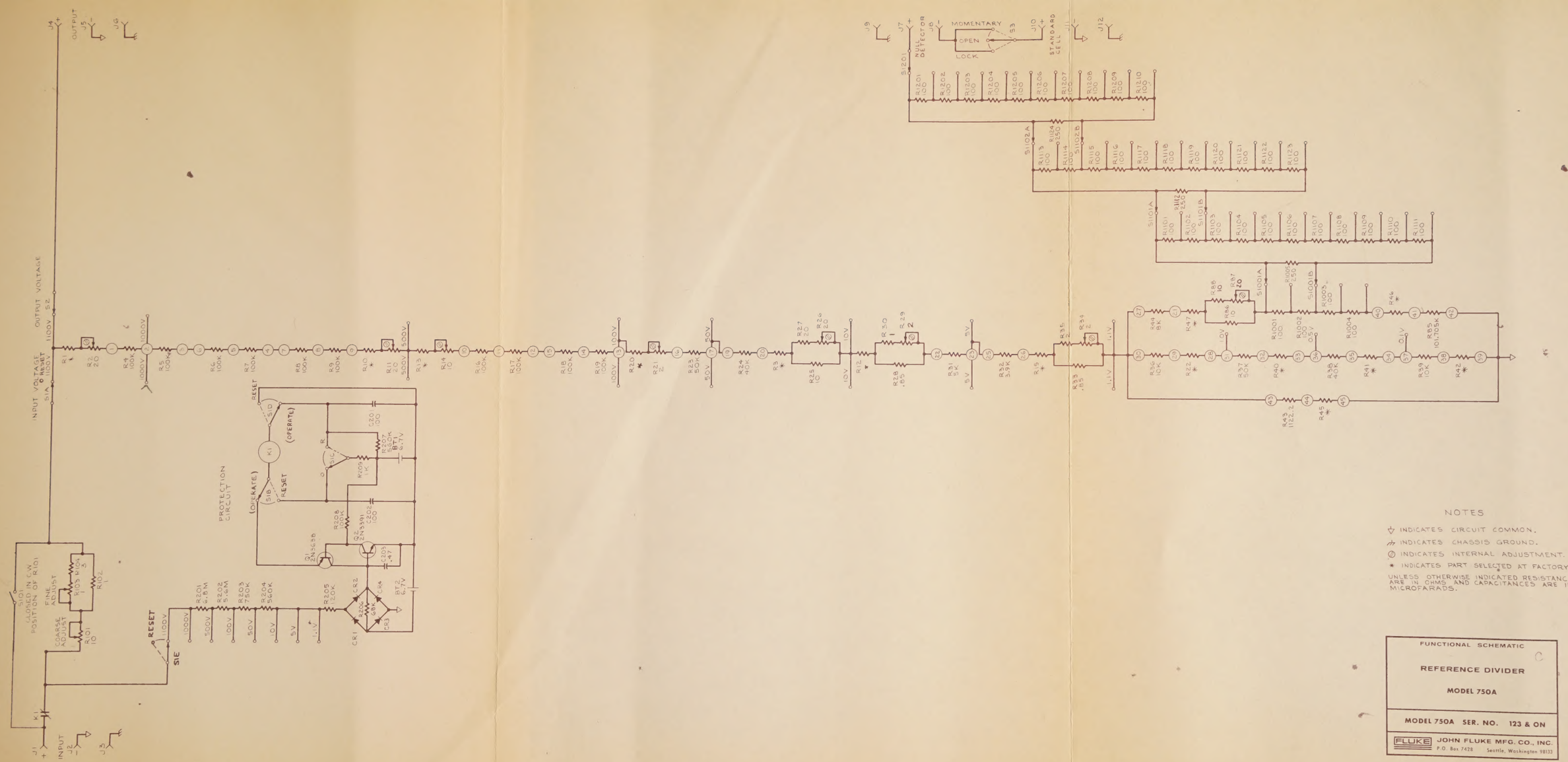
FLUKE (NEDERLAND) N.V.
P. O. BOX 5053
TILBURG, THE NETHERLANDS

FLUKE REGIONAL SERVICE CENTER, UNITED KINGDOM

FLUKE INTERNATIONAL CORP.
GARNET CLOSE
WATFORD, WD2 4TT
ENGLAND

AUTHORIZED SERVICE LABORATORIES INTERNATIONAL

EACH INTERNATIONAL REPRESENTATIVE IS EQUIPPED WITH AN AUTHORIZED SERVICE LABORATORY. PLEASE REFER TO THE INTERNATIONAL REPRESENTATIVE LISTING FOR YOUR SERVICE NEEDS.



NOTES

- ⏚ INDICATES CIRCUIT COMMON.
- ⏚ INDICATES CHASSIS GROUND.
- Ⓘ INDICATES INTERNAL ADJUSTMENT.
- * INDICATES PART SELECTED AT FACTORY.

UNLESS OTHERWISE INDICATED RESISTANCES ARE IN OHMS AND CAPACITANCES ARE IN MICROFARADS.

FUNCTIONAL SCHEMATIC

REFERENCE DIVIDER

MODEL 750A

MODEL 750A SER. NO. 123 & ON

FLUKE JOHN FLUKE MFG. CO., INC.
P.O. Box 7428 Seattle, Washington 98133

www.manualsplus.com
1020788